Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PUBLIC LIBRARY
OCT 19 ...
DETROIT

TOUGHNESS

SMOOTHNESS

LUS... ...S COLOUR

Yes!

and the know-how

Our technical service is always ready to advise on proposed applications of Courtauld's cellulose acetate moulding powders. The colour-range is almost limitless and we can match any colour—translucent, transparent, solid or crystal. We will gladly send you working samples—or an expert to talk things over. And we accept small orders, even for special powders. Lustrous colour combined with toughness and a smooth surface finish make Courtauld's moulding powders an ideal medium for manufacturing a vast range of products. Let us help *you* with your projects.

ALL THE ANSWERS IN

Courtaulds
CELLULOSE ACETATE
MOULDING POWDERS

Marketed by British Celanese Ltd., Little Heath, Coventry. Telephone: Coventry 88031.

BX PRODUCTS *Ready Reference Table*

Form	Trade Name	Composition
Rigid Sheet	Xylonite (Regd.) Bexoid (Regd.) Cobex (Regd.) Lactoid (Regd.) Bextrene (Regd.) Bexoid Film Xylonite Film Styrafoil (Regd.)	Cellulose Nitrate Cellulose Acetate Rigid Vinyl Casein Polystyrene Cellulose Acetate Cellulose Nitrate Polystyrene Film
Flexible Sheet	Velbex (Regd.) Bexthene (Regd.) Film and Layflat Tube Bexlene (Regd.)	Polyvinyl Chloride Polythene P.V.C./Polyester yarn
Moulding Powders U.K. Agents for	Bextrene (Regd.) Bextrene BC.15 Bexoid (Regd.) Ethyl Cellulose Akulon	Polystyrene Toughened Polystyrene Cellulose Acetate Ethyl Cellulose Nylon
Monofilaments	Saran Bexan (Regd.)	Polyvinylidene Chloride Polyvinyl Chloride
Packaging Materials	Bexthene (Regd.) Film and Layflat Tube Styrafoil (Regd.) Bexoid Film Moulding Powders	Polythene Polystyrene Film Cellulose Acetate As above list
For Vacuum Forming	Bextrene Sheeting Cobex Sheeting Bexoid Film & Sheet	Toughened Polystyrene Rigid Vinyl Cellulose Acetate
Extrusions	In most BX materials	Various
Solutions	Bexol (Regd.)	Solutions in Organic Solvents

Write now for your copy of folder giving details of BX product range

For Ex-Stock Orders telephone

Kingswinford 3551—Midlands Depot, Pensnett Trading Estate, Brierley Hill, Staffs
Manchester MOSs Side 2616 — Northern Depot, 15 Park Street, Greenheys, Manchester 15
Glasgow SOUth 4202 — Scottish Depot, 81-83 Oxford Street, Glasgow, C.5
London EUSton 4146 — Miltoid Sales Division, 34-36 Royal College Street, London N.W.1

BX Plastics Ltd

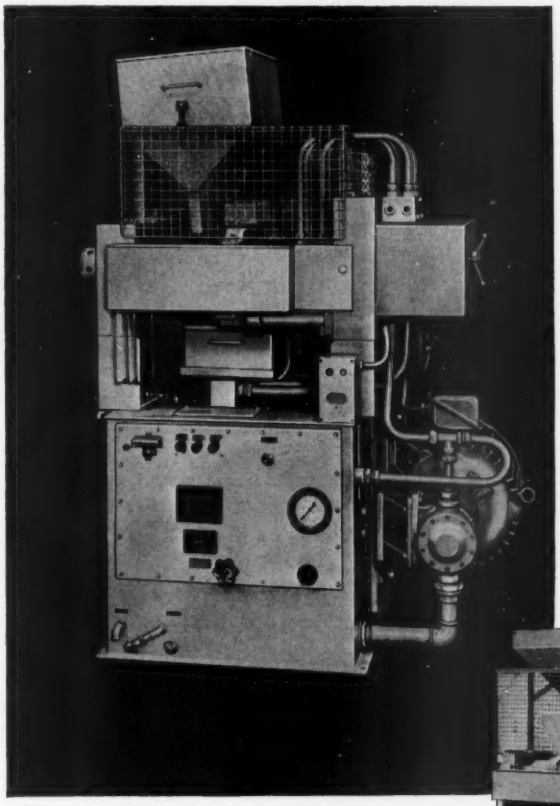
A Subsidiary of The British Xylonite Co Ltd

HEAD SALES OFFICE **HIGHAM STATION AVENUE, LONDON E.4**

Telephone LARkswood 5511 Telegrams Xylonite, Easphone, London

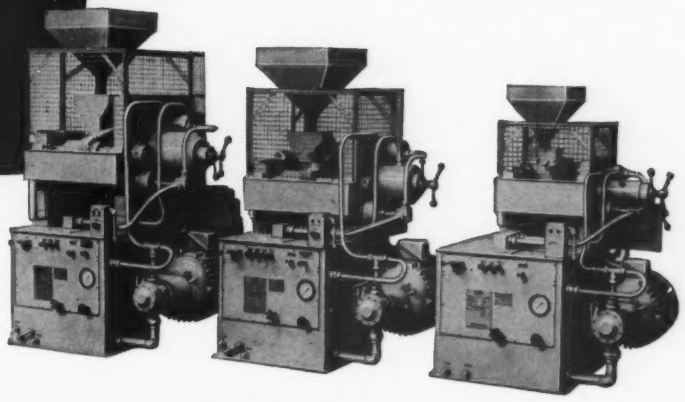
BIPEL PELLETERS

for the modern moulder



BIPEL pelleters differ entirely from conventional types. They are horizontal, are hydraulically operated and form the pellet by a steady squeeze instead of a sharp blow. Tool breakage is practically unknown, production rates are high and the BIPEL machine will often pellet materials considered unpelletable by ordinary machines. Single and multi-punch types are available and the range of sizes has been designed to meet all likely requirements.

BIPEL 35-ton multi-punch horizontal hydraulic pelleter. Makes pellets of $\frac{1}{8}$"–$\frac{3}{4}$" dia. at rates of up to 25,000 per hour. Tool changing takes less than half an hour.



BIPEL horizontal hydraulic pelleters. Three Types—12 ton, 35 and 70 ton—offer respective pellet sizes of $\frac{1}{8}$"–$1\frac{1}{8}$", $1\frac{1}{4}$"–3" and 2"–$4\frac{1}{2}$". Respective maximum rates of production (with single punch) are 2100, 1260 and 720 pellets per hour.

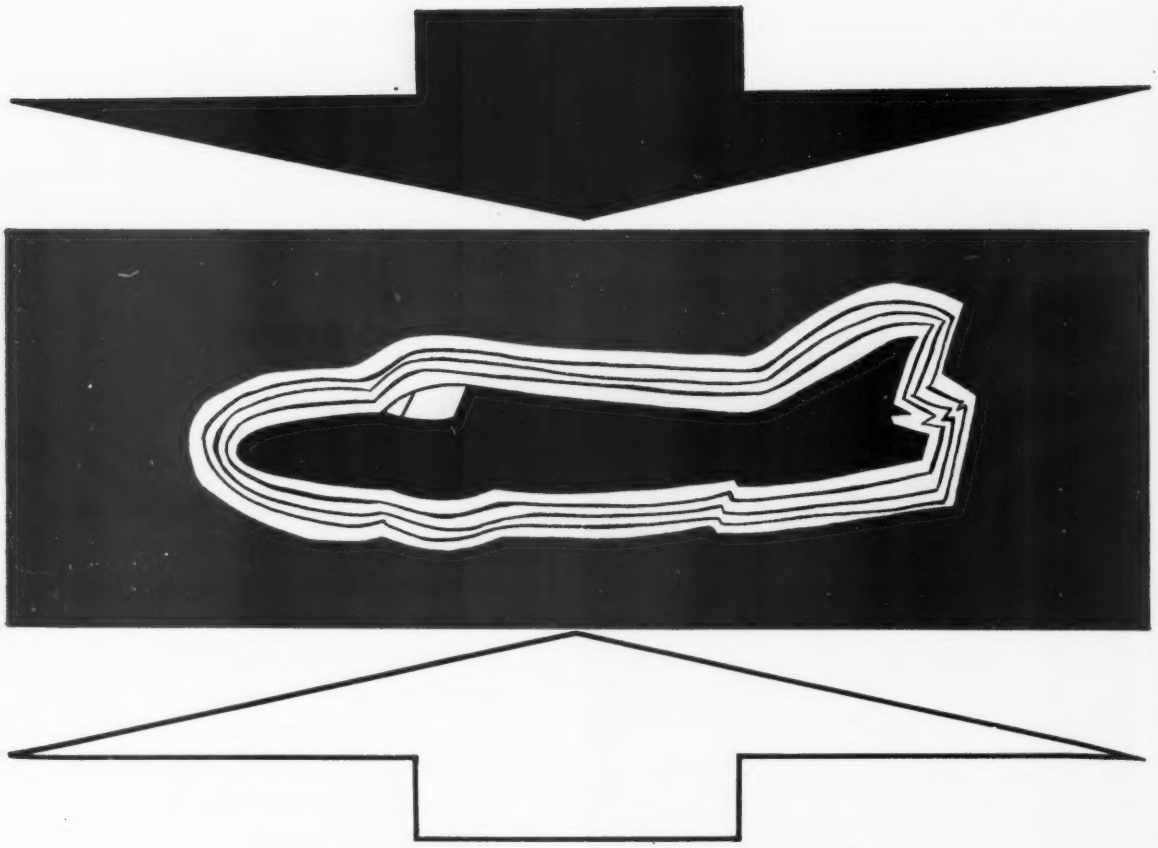
These pelleters typify BIPEL policy—to produce a complete range of novel, virtually foolproof equipment offering higher productivity and considerably lower operating costs all round. No other system of moulding in this country provides a comparable combination of flexibility, productivity and economy.

The **BIPEL** *System of hydraulic moulding*

B.I.P.

B.I.P. ENGINEERING LTD · Streetly Works · Sutton Coldfield · *Telephone:* Streetly 2411

A



The new cost-cutting factor in tool production

Press tools of various types, as well as drill jigs, foundry patterns and vacuum forming moulds can be quickly, accurately and simply produced from "Epikote" Resins—instead of metals. Accuracy is ensured by their very low shrinkage on cure. Casting is simple, and is carried out at low temperatures; subsequent machining and finishing are seldom necessary.

Think of the savings in time and cost!

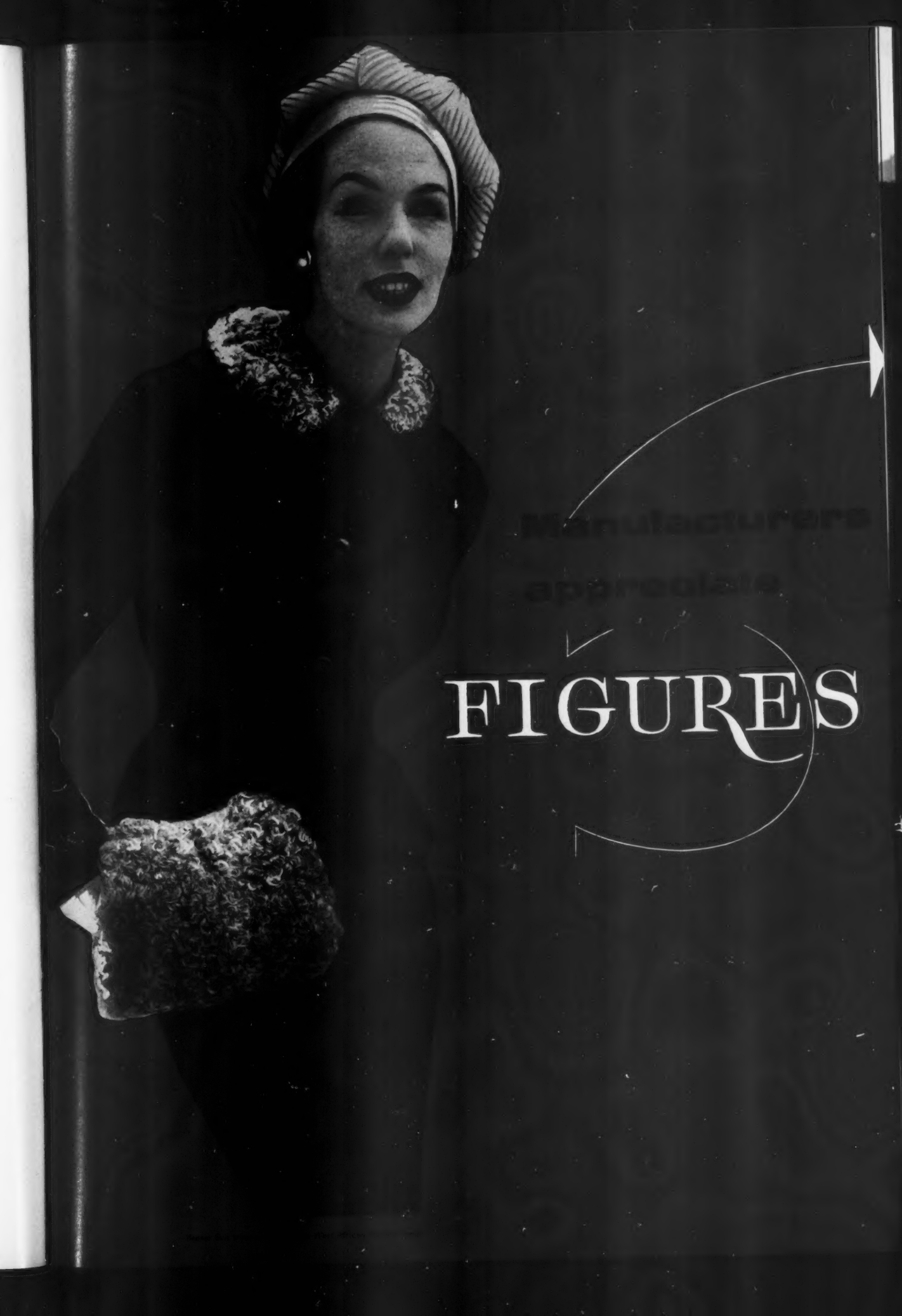
Other advantages are weight savings up to 80 per cent, excellent corrosion and chemical resistance, and easy repair.

Ask for details of these important developments quoting No. EE3.

EPIKOTE EPOXY RESINS

SHELL CHEMICAL COMPANY LIMITED. *In association with Petrochemicals Limited and Styrene Products Limited.*
Divisional Offices: LONDON: Norman House, Strand, W.C.2. Tel: TEMPLE Bar 4455. BIRMINGHAM: 14-20, Corporation Street, 2. Tel: Midland 6954-8. MANCHESTER: 144-6, Deansgate. Tel: Deansgate 6451. GLASGOW: 124, St. Vincent St., C.2. Tel: Glasgow Central 9561. BELFAST: 35-37 Boyne Square. Tel: Belfast 26094. DUBLIN: 53, Middle Abbey Street. Tel: Dublin 45775.

"EPIKOTE" *is a Registered Trade Mark*


manufacturers
appreciate
FIGURES

The FACTS are in the FIGURES

Specification Model 25

Approximate Extrusion Capacity* Polyethylene	150 lbs./hr.
Standard Screw Length/ Diameter	15:1
Heating	Barrel: 3 zones, total 9 kw. Clamshell: 2 zones
Cooling	Barrel: 3 zones Manual or Auto Control Hopper: Jacket Screw
Reduction Gear	3" Worm
Drive	10 H.P.
Floor Space	42" x 19" Extruder 48" x 19" Control Cabinet
Weight Extruder Total	1,250 lbs. Extruder 850 lbs. Control 400 lbs. Extruder 850 lbs. Control

Specification Model 40

Approximate Extrusion Capacity* Polyethylene	250 lbs./hr.
Standard Screw Length/ Diameter	15:1
Heating	Barrel: 3 zones, total 12 kw. Clamshell: 2 zones
Cooling	Barrel: 3 zones Manual or Auto Control Hopper: Jacket Screw
Reduction Gear	4" Worm
Drive	15 H.P.
Floor Space	52" x 22" Extruder 48" x 19" Control Cabinet
Weight Extruder Total	1,750 lbs. Extruder 1,250 lbs. Control 500 lbs. Extruder 1,250 lbs. Control

* Material output varies with the material used, the form in which it is fed, the screw design, etc.

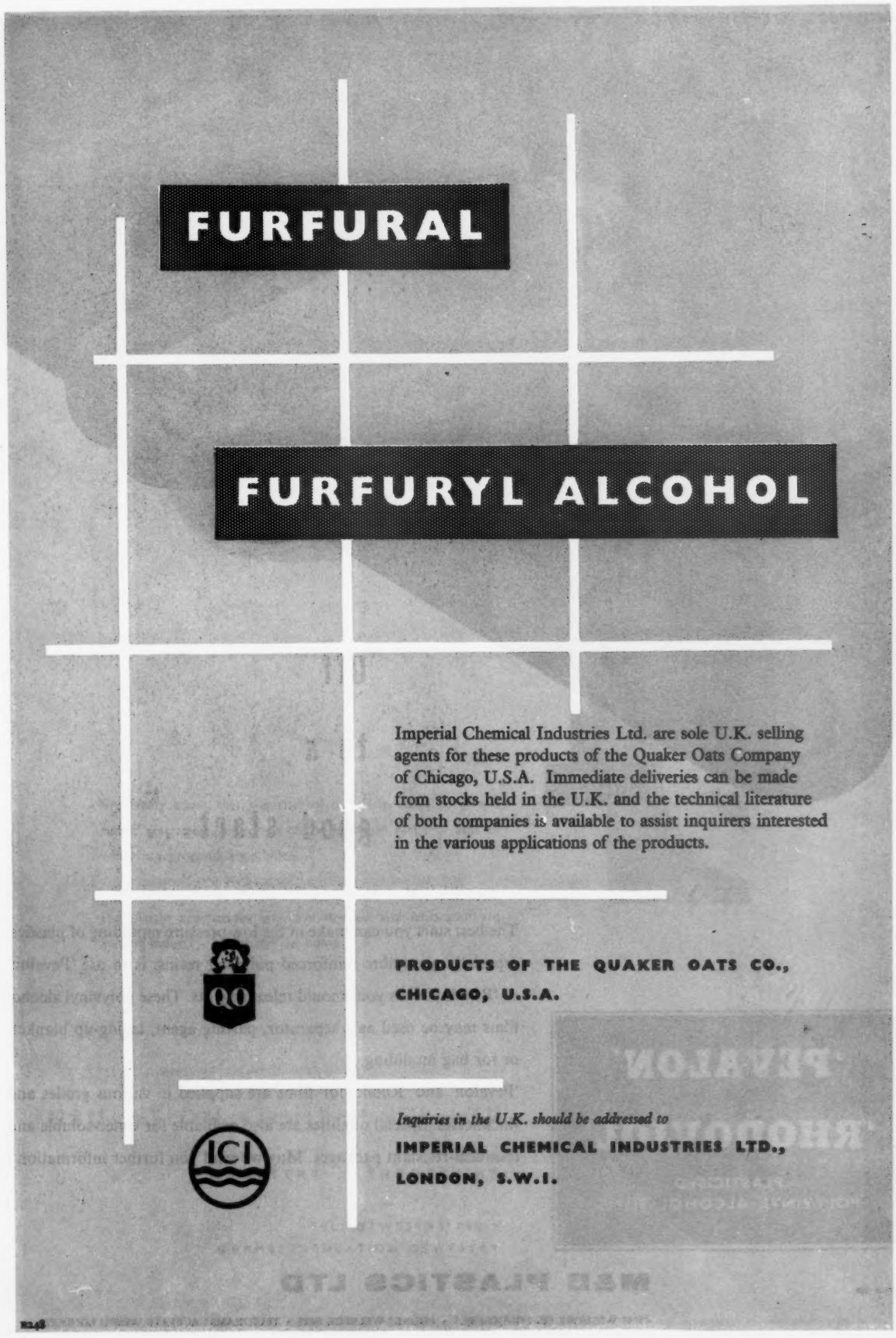
The quality of the materials, the precision of the engineering, the design of the heating, cooling and lubrication systems, and the exceptional ease of control and maintenance, all reflect PECO's close study and understanding of the manufacturer's requirements.

A Division of the PECO organisation is exclusively concerned with research and development in the field of plastics. PECO's After-Sales Service has an excellent reputation: as you would expect — first-class engineers provide a first-class service.

PECO PRODUCTS

PECO

PECO MACHINERY SALES (WORCESTER) LTD.


FURFURAL
FURFURYL ALCOHOL
Imperial Chemical Industries Ltd. are sole U.K. selling agents for these products of the Quaker Oats Company of Chicago, U.S.A. Immediate deliveries can be made from stocks held in the U.K. and the technical literature of both companies is available to assist inquirers interested in the various applications of the products.
QO
PRODUCTS OF THE QUAKER OATS CO., CHICAGO, U.S.A.
ICI
Inquiries in the U.K. should be addressed to
IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1.

Off to a good start...

The best start you can make in the low pressure moulding of plastics, especially glass fibre reinforced polyester resins, is to use 'Pevalon' or 'Rhodoviol' as your mould release agents. These polyvinyl alcohol films may be used as a separator, parting agent, laying-up blanket, or for bag moulding.

'Pevalon' and 'Rhodoviol' films are supplied in various grades and thicknesses. Special qualities are also available for water-soluble and chemical-resistant packages. May we send you further information?

'PEVALON'

'RHODOVIOL'

PLASTICISED
POLYVINYL ALCOHOL FILMS

PLA 140

M&B PLASTICS LTD

45/47 WIGMORE ST. LONDON W.1 · PHONE: WELBECK 0425 · TELEGRAMS: ACETATE WESDO LONDON

a step in the right direction, consult

We freely admit that the title of our Firm tends to give a rather restricted conception of the immense range of uses to which our products are applied.

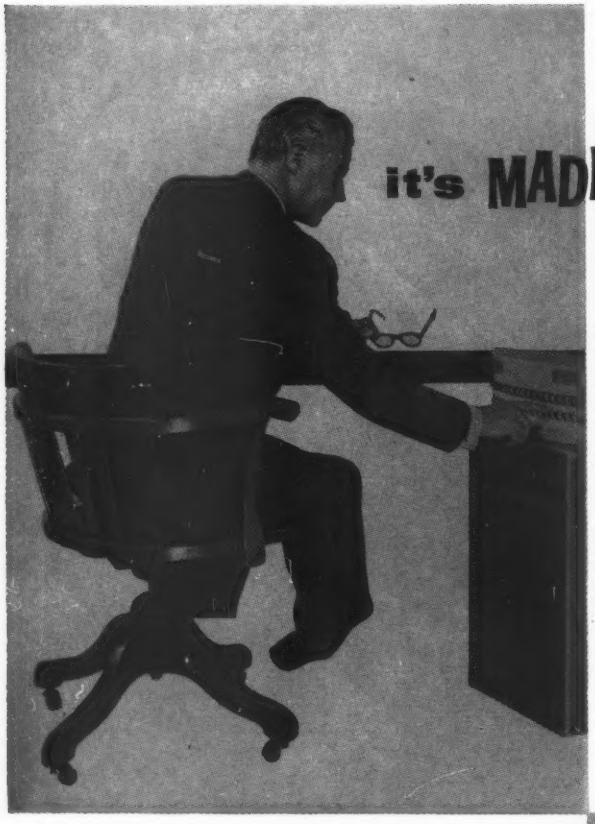
On land, sea and in the air, north, south, east and west, the plastic productions we have devised and fabricated are serving Industry, Travel and the home.

INSULATION EQUIPMENTS LTD

OSWESTRY · SHROPSHIRE

TEL: OSWESTRY 790-1
GRAMS: INSULATION OSWESTRY

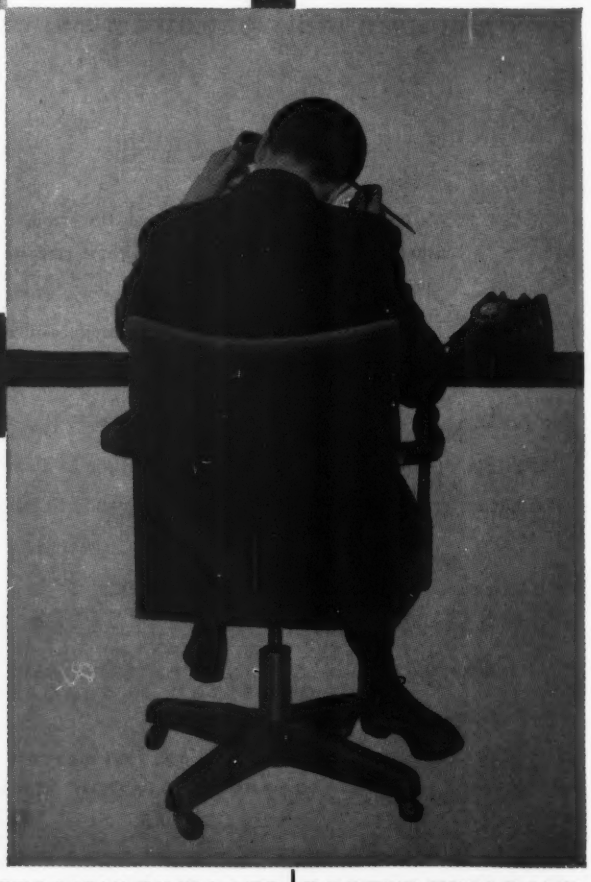
A new brochure we have recently published will help to tell you of the service we offer—may we send you a copy?



it's MADNESS Murgatroyd !

Late delivery, then poor finish! Why on earth didn't you go to Rootes for plastic parts? They *understand* plastics; do everything from making the tools to complete production of compression and injection mouldings.

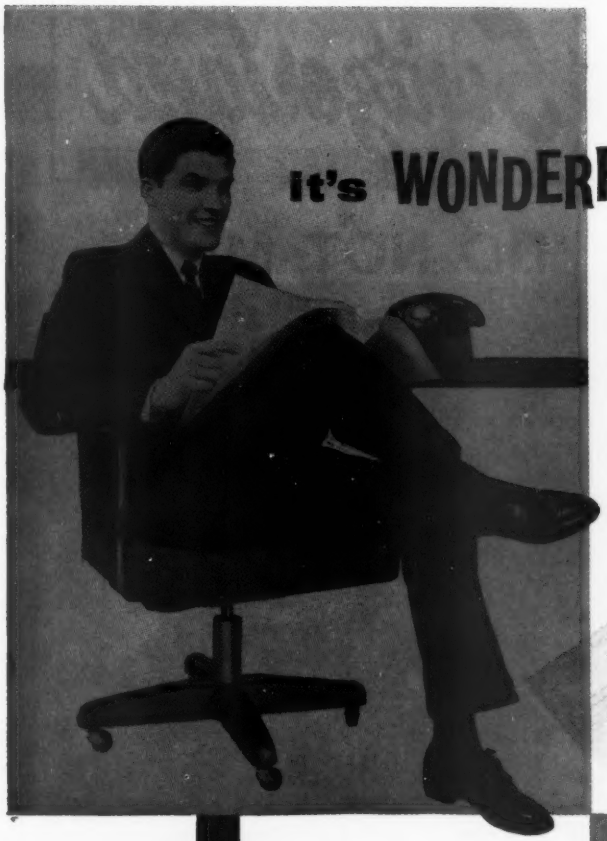
And their keenly competitive prices are hard to reconcile with the more-than-worthwhile job they turn out. Anyway, once you've dealt with them you'll see why I'm so insistent on all things plastic being given to Rootes to handle.



rely on

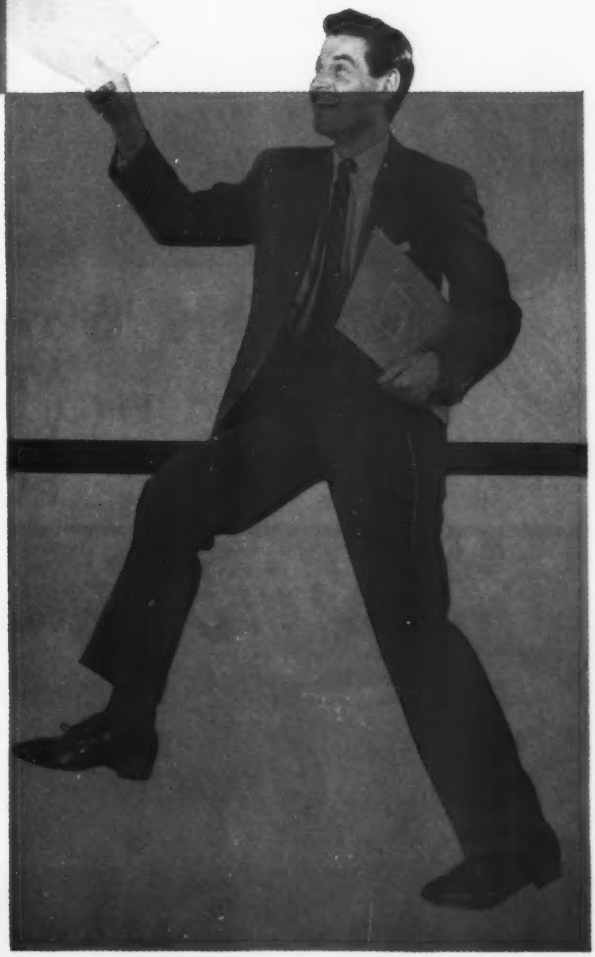
Smee's R113

ROOTES PLASTICS LTD | ROOTES MOULDINGS LTD | ROOTES TOOLS LTD



it's WONDERFUL Withingstall !

Ever since that rocket from the Old Man about not using Rootes for plastic mouldings, I've been realising the wisdom of his words. Rootes have given me just what I wanted—when I wanted it—as these progress reports confirm. Though our demands were steep enough, somehow Rootes came up with the right answer every time—whatever the material. Glad the Old Man gave me that tip. The old bounder knows a thing or two when it comes to plastics —and Rootes plastics in particular.



for plastic mouldings

of every description

SLOUGH | BUCKS | Tel: Slough 24461 *Contractors to M.O.S., Admiralty, etc. A.I.D., A.R.B. Approved.*

HOLZVERZUCKERUNGS A.G. OF... Switzerland

DO NOT MAKE SPUTNIKS

BUT DO MANUFACTURE

Grilon

NYLON 6 THE VERSATILE POLYAMIDE PLASTIC

for

★ INJECTION MOULDING —the fastest moulding cycles

★ EXTRUSION —the widest viscosity range

★ HIGH TEMPERATURE RESISTANCE —heat stabilised grades

★ COLD TEMPERATURE RESISTANCE —cold stabilised grades

★ CABLE COVERING —various qualities

★ SPECIAL APPLICATIONS —special grades

★ MONOFILAMENTS —bristles, fishing lines, etc.

★ RODS & SHEETS —machining

"Made in Switzerland" synonymous with Quality

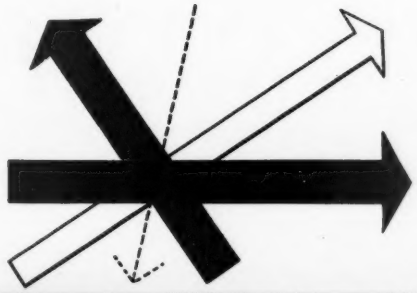
Manufactured by Holzverzuckerungs A.G. Zurich

Deliveries can be made ex-stock London from our exclusive Representative in U.K.

Grilon

GRILON PLASTIC MACHINERY LTD.

47 VICTORIA STREET, LONDON, S.W.1



NEW PRODUCT DIRECTIONS

Destructive ultraviolet light inches away
. . . yet polystyrene is protected by

CYASORB* UV 9 LIGHT ABSORBER

Light-sensitive polymers are protected from discoloring or degradation by the remarkable ultraviolet-absorbing efficiency of CYASORB UV 9. Polystyrene light-diffusing panels, for example, are protected from yellowing and cracking through years of exposure to fluorescent lighting—and this protection is extended to every ultraviolet-light-sensitive dye, fabric and finish in the illuminated room. Outdoors, even the sun's most intense ultraviolet radiation is rendered harmless by CYASORB UV 9. Transparent, translucent or pigmented polystyrenes can keep their clarity or color through years of exposure.

Compounders are finding CYASORB UV 9 highly effective as a practical stabilizer for polystyrene. It blends easily, and 0.2 to 0.5% is sufficient to multiply by many times the useful life of plastic products. Full commercial production assures adequate supplies for new users.

Cyanamid's bulletin, CYASORB UV 9 Light Absorber, contains much practical information on CYASORB UV 9. Your New Products man can bring you up to date on other ultraviolet absorbers developed through many years of pioneering research and on recent application developments.

Free UV Test Kit!

Find out exactly how protection against ultraviolet can benefit your own product. Cyanamid will send you an easy-to-use test kit if you'll just check the coupon.

*Trademark

CYANAMID

CYANAMID INTERNATIONAL
A Division of American Cyanamid Company
GENERAL CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N. Y.

Please send ☐ Bulletin ☐ Sample ☐ UV Test Kit
CYASORB UV 9 LIGHT ABSORBER

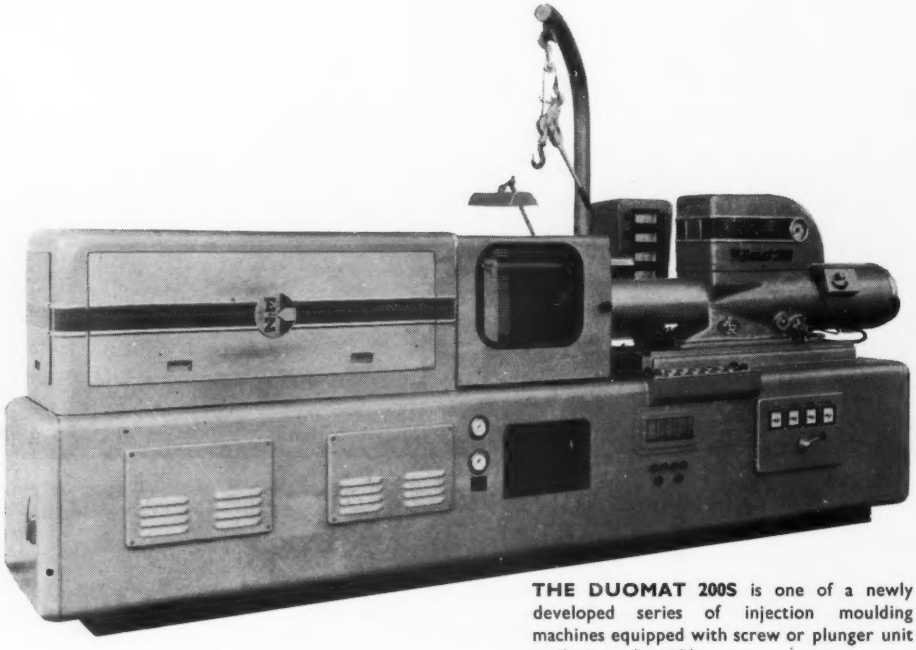
NAME_____
COMPANY_____
ADDRESS_____

ECKERT & ZIEGLER GMBH.

INJECTION MOULDING MACHINES AND -MOULDS

Weissenburg/Bavaria

DUOmat injection moulding machines



THE DUOMAT 200S is one of a newly developed series of injection moulding machines equipped with screw or plunger unit easily interchangable.

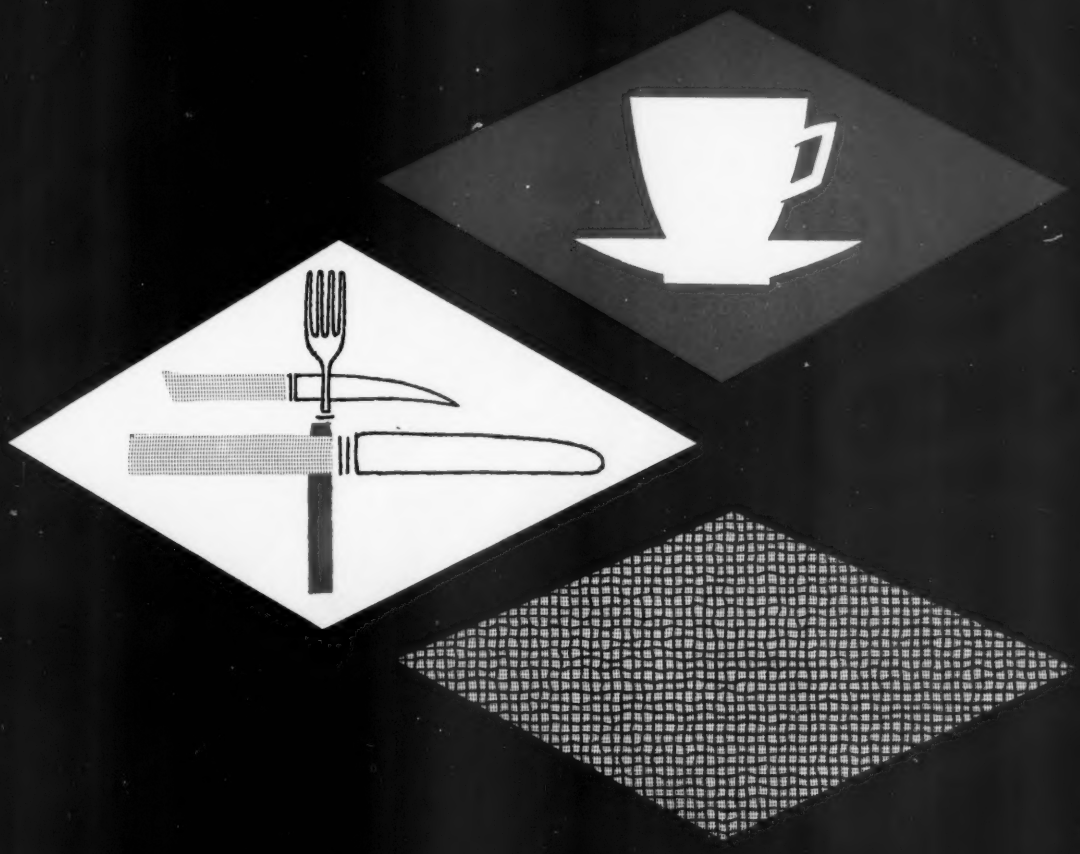
SOLE AGENTS U.K. AND EIRE

ED. BRAND LTD

PLASTICS DIVISION

Est. 1900

Head Office: 9, ST. CROSS STREET, HATTON GARDEN, LONDON, E.C.1. CHANCERY 4091 (3 Lines)

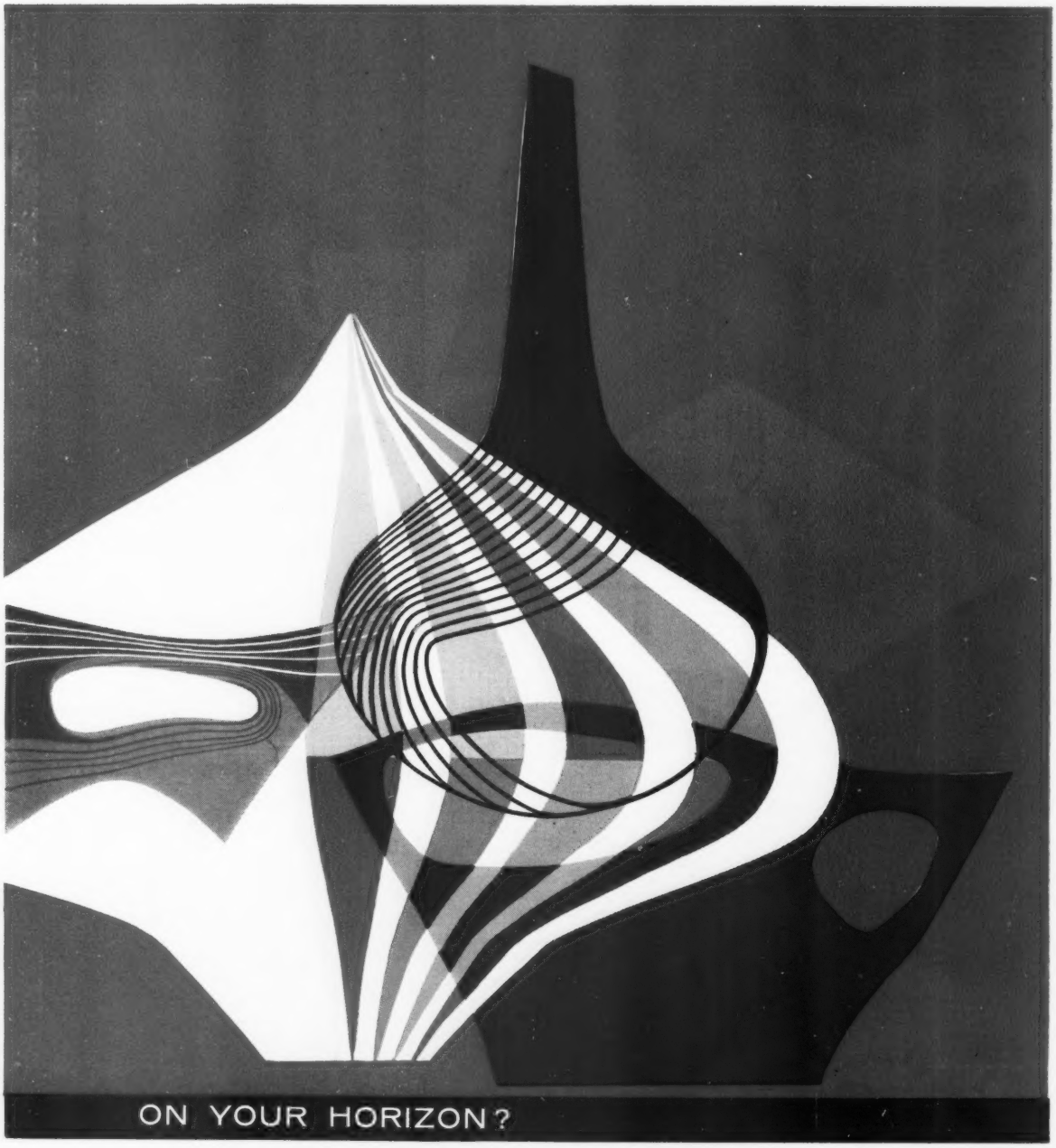


Marvellous Melamine!

British Oxygen Chemicals
supply Melamine to makers of resins
and moulding powders for:—

TABLEWARE · DECORATIVE LAMINATES
PAINTS · FABRICS · PAPERMAKING

BRITISH OXYGEN CHEMICALS LTD.
Bridgewater House, St. James's, London, S.W.1.
Tel: Whitehall 9777



At this moment, on a drawing board somewhere, is a design which could mean an entirely new product. It could be a product for either light or heavy industry: for instance, toys or electronics, household appliances or chemicals. But whatever the field, when the time comes for bulk manufacture, there are powerful reasons—mechanical, chemical, dielectric and economic—for believing that the material chosen will be high impact polystyrene.

When that happens it will not be just happy chance if the selected brand of polystyrene is Iridon. Iridon Limited have the resources and the experience to meet the demands of every new development the moment it becomes a mass market proposition. Iridon Limited are constantly perfecting new techniques, new processes; constantly exploring the immense possibilities in plastics—always with the aim of fitting them for the ever-changing pattern of industry.

If your particular pattern needs the best in thermo-plastic sheeting to add to its competitive potential, you could profitably contact Iridon.

Iridon

LIMITED

1 Avery Row, Grosvenor St., London, W.1.
Tel: HYDe Park. 9261

Member of the CP group—one of the world's major manufacturers of plastics sheet and film.

STEARINES OF EVEN HIGHER QUALITY

New plant—new specifications—new quality. That's the story behind the PRISTERENE range.

The introduction of a second Emersol Plant has enabled Price's to offer customers a range of stearines with improved specifications *all round*. The result? You get stearines of *Increased Stability*, affording greater resistance to rancidity and off-odours, and to the development of colour on heating. And these new stearines can be bought in the form of *Beads*, as well as Flake, Powder, and Block.

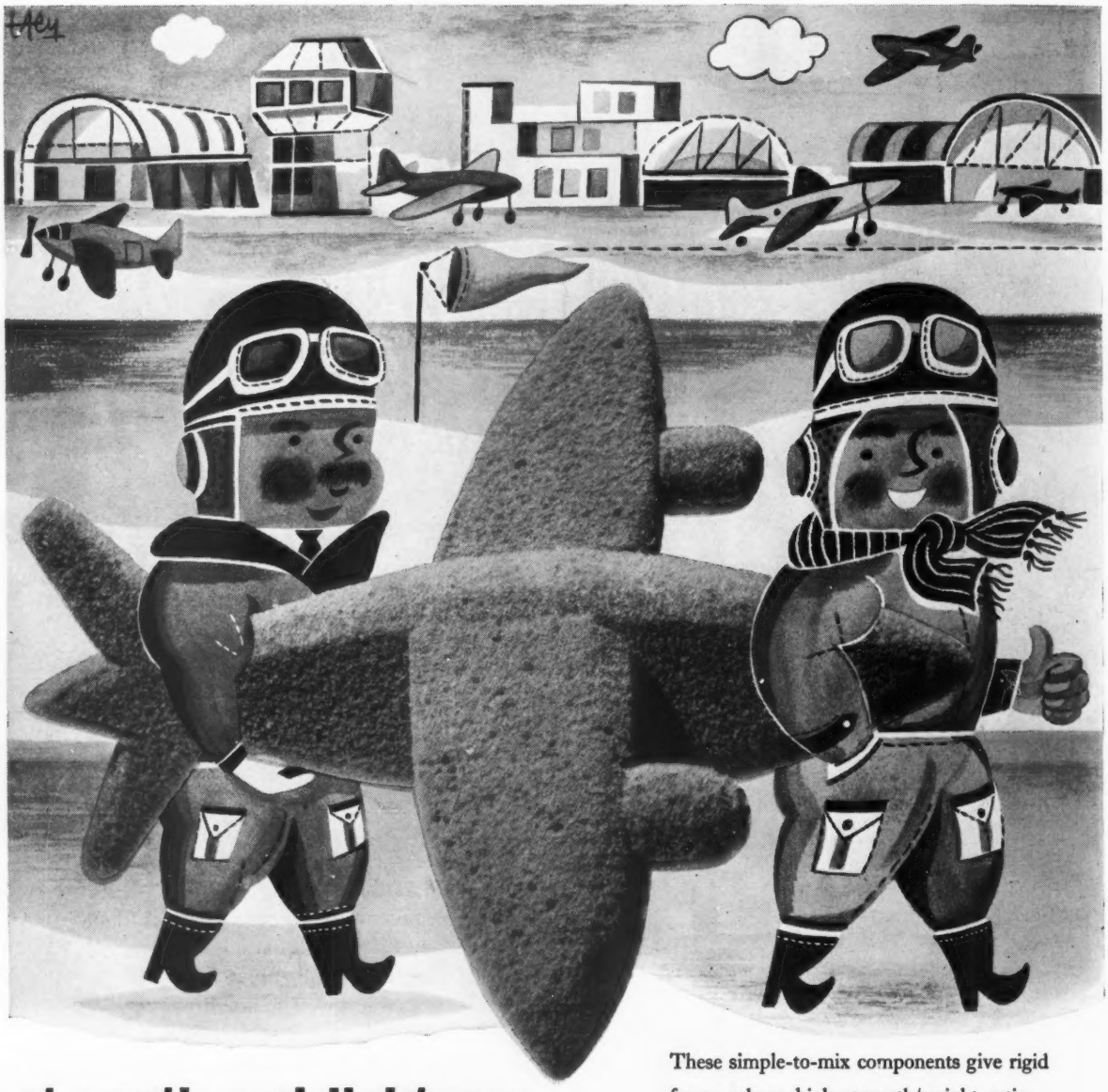
We shall be pleased to send you further particulars of PRISTERENE, and can guarantee regular deliveries. Write or phone to:—

PRICE'S (Bromborough) LIMITED

Bromborough Pool · New Ferry · Nr. Birkenhead · Tel: Rock Ferry 2020

OLEINES · STEARINES · FATTY ACIDS · FATTY ALCOHOLS · TEXTILE OILS

P839-6606-100



strength and lightness

with Isocyanates

and POLYESTERS by ICI

Ask for particulars of the foam producing products:
Daltolacs 21, 22 & 24 and **Suprasec D.**

These simple-to-mix components give rigid foams whose high strength/weight ratio commends them to the aircraft industry for the manufacture of strong, rigid constructions, easy to fabricate, light in weight and with good thermal insulation. The components are easily mixed on site. Foaming takes place in the cavity to be filled and a bond is set up with the material in contact with the foam, to give added strength and rigidity. These foams provide excellent electrical insulation for electrical equipment and give good protection against mechanical and thermal shock.

Enquiries should be addressed to: I.C.I. Sales Development Department (Polyisocyanates), Ship Canal House, King Street, Manchester 2.

D.960

IMPERIAL CHEMICAL INDUSTRIES LIMITED LONDON SWI ENGLAND

SETTING A STANDARD

is both a privilege & a responsibility

A COMPLETE RANGE
of tube closures made from
WOOD FILLED UREA
PAPER FILLED UREA
and
POLYTHENE
MATERIALS

is available for customers' individual needs. Each type has its advantages and the original U.M.P. Valve-type wadless closure, (Patented) as the lowest priced of all, has found universal approval.

Below is a view of one of the injection moulding sections of U.M.P's Plastics Division (comprising presses from ½ oz. to 32 oz.) where U.M.P's assortment of
STANDARD POLYTHENE CAPS
as well as proprietary caps to customers individual requirements are produced on fully automatic presses.

U·M·P

For Tubes and Plastics

UNIVERSAL METAL PRODUCTS LTD.
SALFORD 6 LANCS. *Telephone:* PENDLETON 4444
LONDON OFFICE: ARGYLE HOUSE, 29/31, EUSTON ROAD, N.W.1. TEL. TERMINUS 2073

WILL THAT METAL BE FOUND

by your calender...

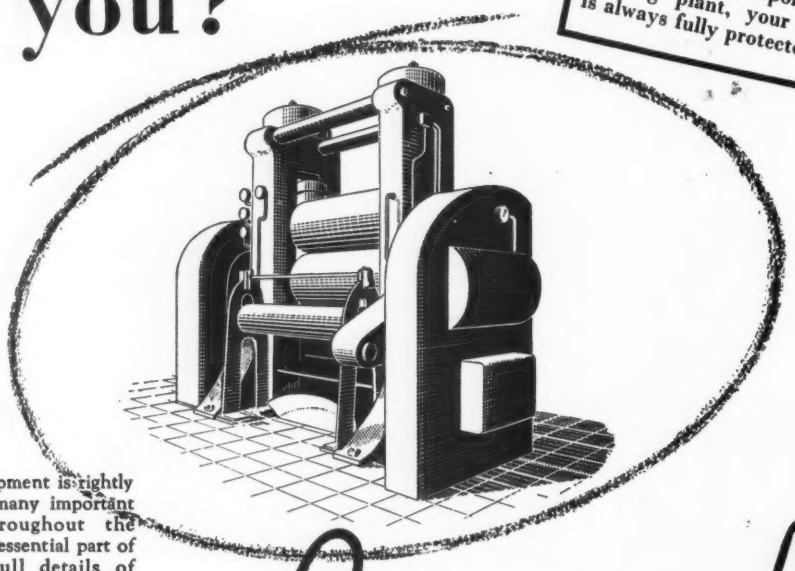
or you?

Metal in Plastic Mix

ANY small piece of metal in the plastic mix can cause untold damage to expensive plant and machinery.

Far better that it be found by the CINTEL Electronic Metal Detector, which will detect any metal, ferrous or non-ferrous, and give warning of its presence, before damage can ensue.

With CINTEL Equipment, which can be incorporated into existing plant, your calender is always fully protected.



CINTEL Equipment is rightly regarded by many important concerns throughout the country as an essential part of the plant. Full details of CINTEL Electronic Metal Detectors will gladly be sent on request.

Cintel

CINEMA-TELEVISION Ltd.

WORSLEY BRIDGE ROAD · LONDON · SE26

Telephone HITher Green 4600

A Company within the Rank Organisation

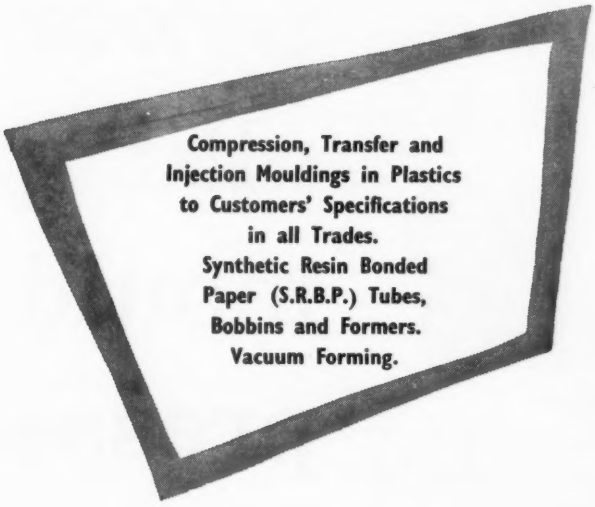
SALES AND SERVICING AGENTS: McKellen Automation Ltd., 122 Seymour Grove, Old Trafford, Manchester, 16 · Hawnt & Co., Ltd., 59 Moor St., Birmingham, 4 · Atkins, Robertson & Whiteford Ltd., Industrial Estate, Thornliebank, Glasgow

Ask

CRYSTALATE

to quote for

MOULDED PLASTICS



CRYSTALATE (MOULDINGS) LTD. associating **MICA PRODUCTS LTD.**

Crystalate House, Tonbridge, Kent.

Phones: Tonbridge 2261/5 (25 lines)

59 years experience at your service

FRASER

Mono-radial hydraulic pumps and control valves are particularly suitable for operating all types of moulding presses. In addition Fraser manufacture a full range of ancillary equipment for both manual and fully automatic control. Our long experience in these matters is always at our customers' disposal, and we shall be pleased to advise upon proposed applications and make recommendations for the most suitable type of equipment.

MONO-RADIAL CONSTANT DELIVERY PUMP. An ideal unit for moulding presses, combining a large volume at low pressure for the approach in closing stroke and a small volume at high pressure for the final pressing application.

DERI-SINE PUMP. For pressures up to 2000 p.s.i. and outputs up to 90 g.p.m. They give true straight-line flow free from pulsation. High volumetric efficiency and hydraulic and dynamic balance are two important characteristics.

dependable hydraulic power for all types of moulding presses

for efficiency fit a

FRASER

ANDREW FRASER & COMPANY LTD

29 BUCKINGHAM GATE

LONDON SW1 Tel: VICtoria 6736-9

P. 1057

we do the lot

we advise on product
design — we design the
tools — we make the tools
and produce the parts
to your satisfaction
and when it comes to quality — we think we're *IT*

RESINOID AND MICA PRODUCTS LIMITED
MARY STREET, BALSALL HEATH, BIRMINGHAM

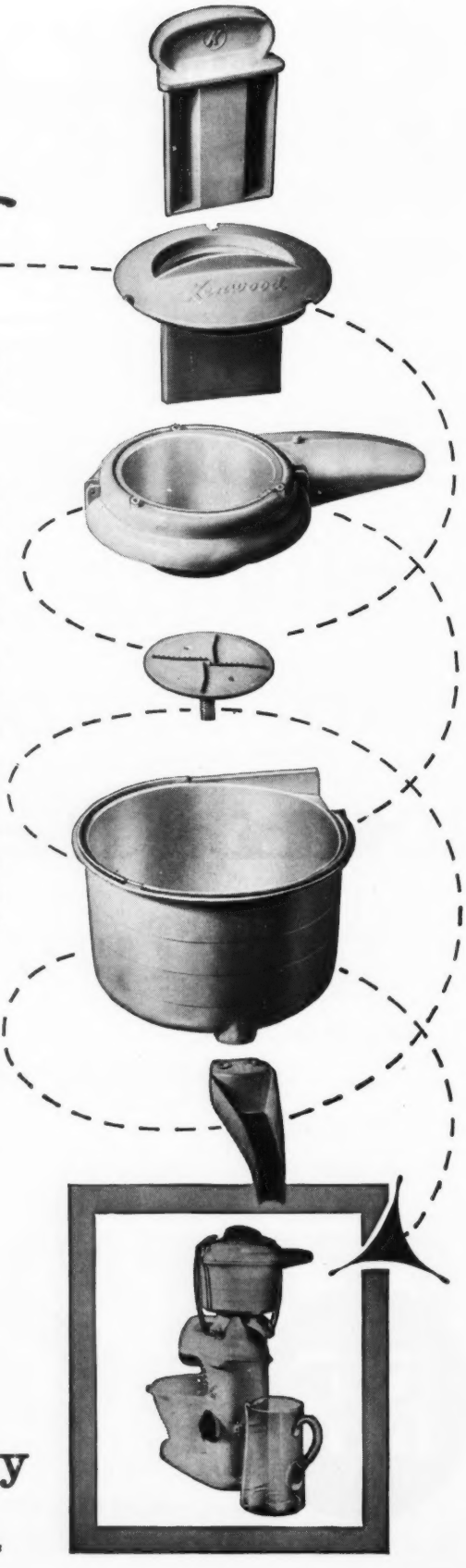
RMP

A CREATIVE SERVICE FOR MOULDED AND FABRICATED PLASTICS

ring CALthorpe 1303 GEORGE RAY, SALES MANAGER

We came together

...TO SEPARATE!



Ekco Plastics worked in the closest conjunction with the Kenwood Manufacturing Co. Ltd. to solve the many tricky problems involved in producing the new Continuous Juice Separator. One of the most complex mouldings was the Grater plate which has four flash-free stainless steel cutters moulded as an integral part—sharp cutting edges foremost and incorporating a nylon thread.

This was just another of the many complex jobs faced by Ekco Plastics almost every day. That we can claim to have solved the vast majority of them is due to the skill and ingenuity of the Ekco design, tooling and moulding engineers. *Why not let them get to work on any plastics problem* you *may have?*

Council of Industrial Design
AWARD FOR EKCO!

The Ekco 'Superbath' was chosen by the Council of Industrial Design as 'one of the twenty most outstanding designs of the year'. This coveted honour is not only a tribute to the design, tooling and moulding skill of Ekco Plastics, but confirms the great advantages to be gained by consulting us on any moulding problem *you* may have.

EKCO

Plastics for Industry

EKCO PLASTICS LTD • SOUTHEND-ON-SEA • ESSEX

Member of the British Plastics' Federation

DIELECTRIC PRE-HEATING ?

THEN AUTOMATICALLY YOUR CHOICE

"HASLER"

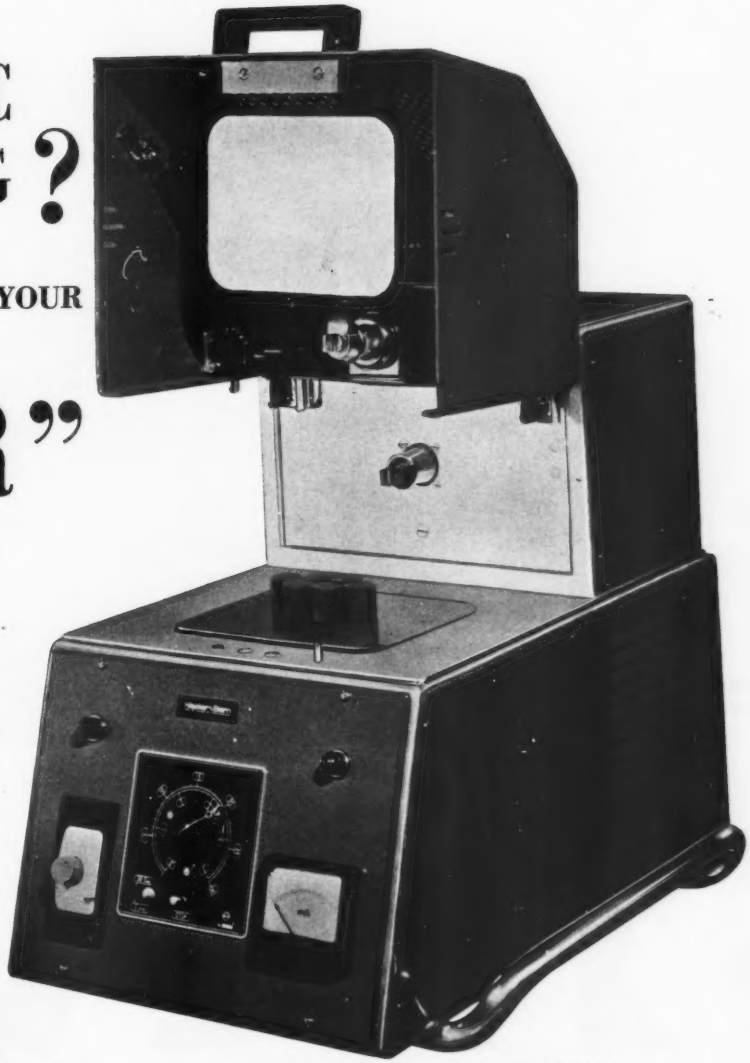


Illustration shows a 500 watt High Frequency (40 mc/s.) Dielectric Pre-Heater Manufactured by Hasler SA. Berne and used in the production of their World Famous telecommunications equipment, in which field they are Switzerland's Oldest and Largest organisation.

SMALL COMPACT TABLE TYPE HEATER.

Dimensions: 22½ in. × 13½ in. × 19¼ in.
Operating Capacitor: 7½ in. × 5½ in.
Weight: 110 lbs.

FAST HEATING RATES:

250 grs. to 200 F. (93° C.)—50 seconds.
55 grs. to 250 F. (120° C.)—20 seconds.
11 grs. to 300 F. (150° C.)—10 seconds.
(Typical Phenolic Moulding Powder.)

Maximum Capacity 450 grs.

GUARANTEED FOR ONE YEAR.

FILTERED AIR-BLAST FOR VALVE COOLING

FULLY AUTOMATIC OPERATION.

The oven-lid opens and the timer resets at the end of each heating cycle.

IDEALLY SUITABLE FOR USE BY UNSKILLED PERSONNEL.

COMPREHENSIVE MAINTENANCE SERVICE AVAILABLE THROUGHOUT THE UNITED KINGDOM.

EMPLOYS HIGH FREQUENCY (40 mc/s).

Giving efficient and even heating.

VERY ACCURATE TIMER.

With large scale, double range.
Calibrated 0—30 secs., 0—5 mins.

Even the excellent illustration above fails to do justice to the unrivalled quality of the HASLER equipment. We would, therefore appreciate an opportunity of installing a pre-heater in your works for one week's trial, without obligation.

Midland Sales & Service:—**E. PEART** (Electronics) **COMPANY LIMITED**
Onward Works, Manchester Road, Hyde, Cheshire. Telephone: Hyde 3545

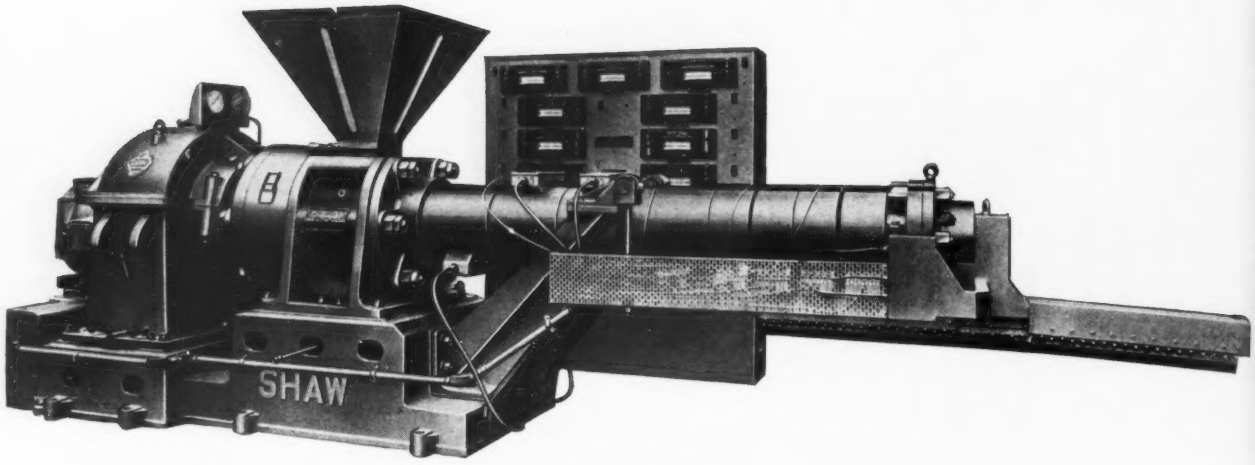
TELEPHONE ABBEY 7575/6

HASLER TELEGRAPH WORKS LTD

TELEGRAMS SIVAD, LONDON

26 VICTORIA STREET, LONDON, S.W.1

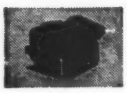
PLASTIC EXTRUDER. Fine temperature control is a vital feature of Francis Shaw extruders. All-electric heating in separate zones is provided, each zone being separately controlled by proportioning instruments. A wide range of screw and die designs is available for the production of piping, sheeting, sections and the sheathing and insulation of cables. Extruder sizes from 1″ to 12″.



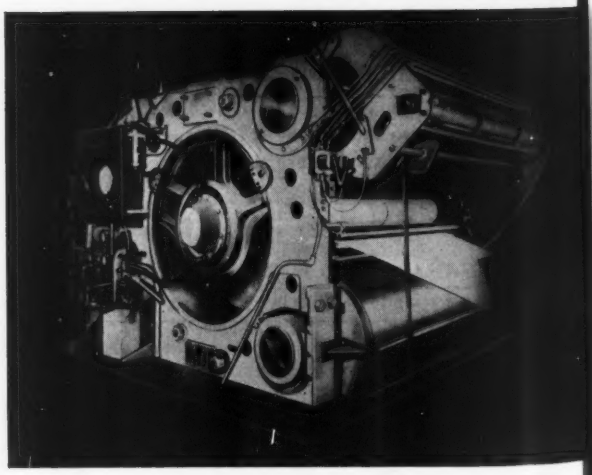
FRANCIS SHAW

quality engineering puts efficiency into Shaw machines

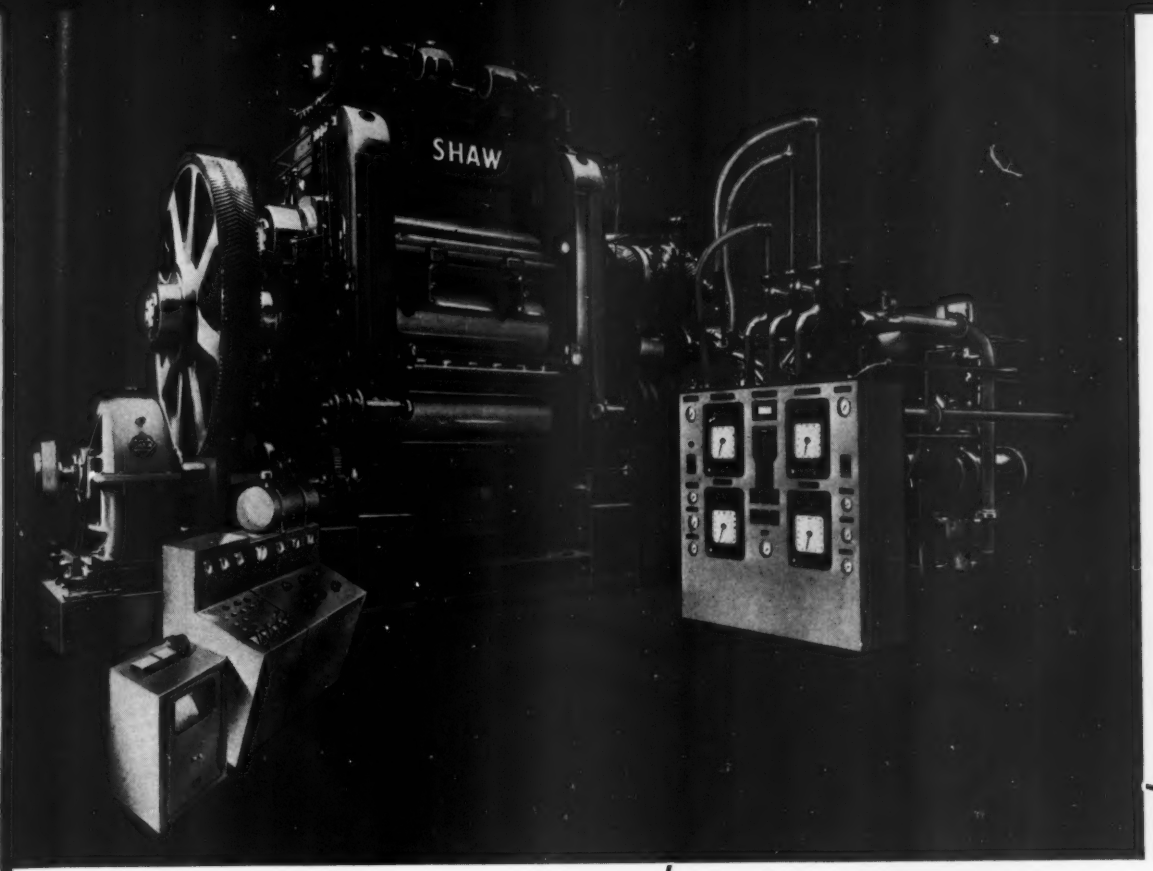
The cost-cutting performance of every Francis Shaw machine and its thorough dependability are the result of long experience and unvaryingly high standards of engineering in every detail of manufacture.
Close-limit accuracy and rigorous inspection during manufacture guarantee to the user a consistently high quality output from Francis Shaw equipment.



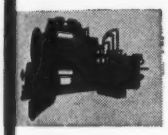
SHAW ROTOCURE. For perfect quality continuous curing of belting, matting, flooring and other flat products, eliminating the time-wasting operations of opening, cooling, re-heating and closing of hydraulic presses.



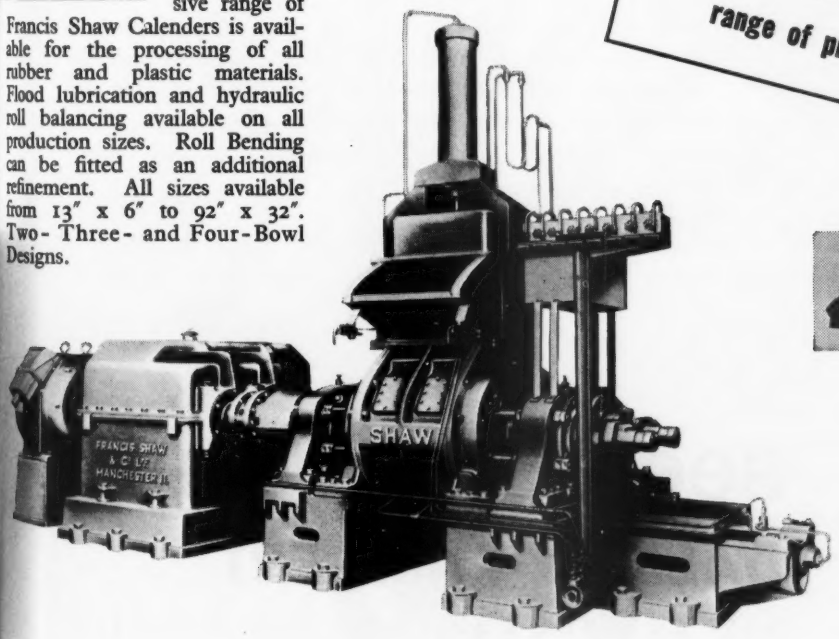
QUALITY ENGINEERING FOR QUANTITY PRODUCTION

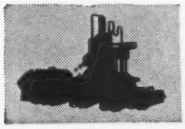


Francis Shaw are available for the design, manufacture and installation of a wide range of processing equipment



CALENDER A comprehensive range of Francis Shaw Calenders is available for the processing of all rubber and plastic materials. Flood lubrication and hydraulic roll balancing available on all production sizes. Roll Bending can be fitted as an additional refinement. All sizes available from 13″ x 6″ to 92″ x 32″. Two- Three- and Four-Bowl Designs.





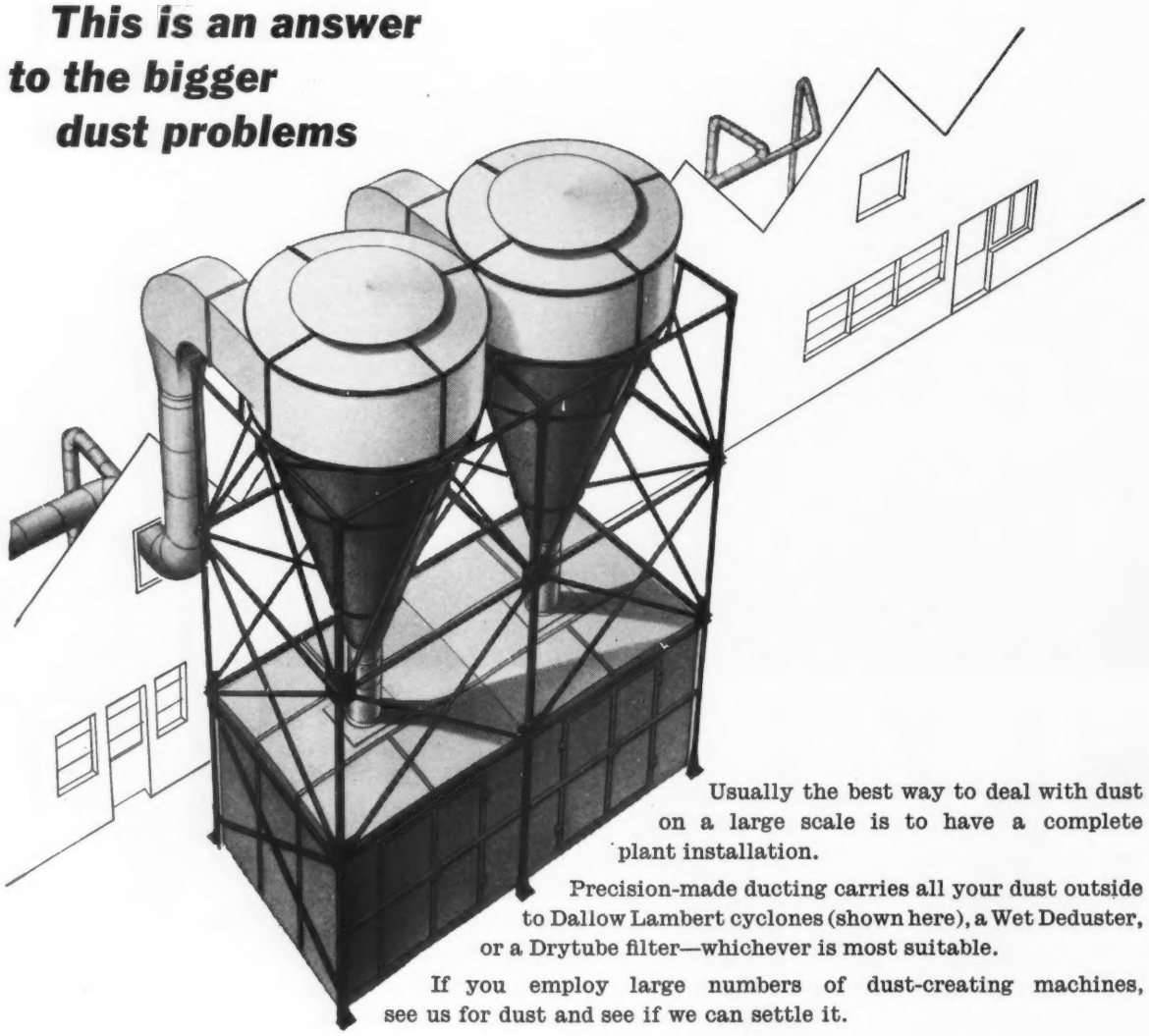
INTERMIX. A robust high efficiency heavy duty internal mixer for mixing plastic compounds at lower-than-normal temperatures. It is supplied with steam heating for plastics and other materials, and the exclusive rotor design ensures consistent high quality mixing.

FRANCIS SHAW & COMPANY LIMITED MANCHESTER 11 ENGLAND

TELEPHONE EAST 1415-8 TELEGRAMS CALENDER MANCHESTER TELEX 66-357

LONDON OFFICE 22 GREAT SMITH ST SW1 TEL ABBEY 3245 (3 LINES) GRAMS VIBRATE LONDON TELEX 2-2250

This is an answer to the bigger dust problems



Usually the best way to deal with dust on a large scale is to have a complete plant installation.

Precision-made ducting carries all your dust outside to Dallow Lambert cyclones (shown here), a Wet Deduster, or a Drytube filter—whichever is most suitable.

If you employ large numbers of dust-creating machines, see us for dust and see if we can settle it.

see us for dust

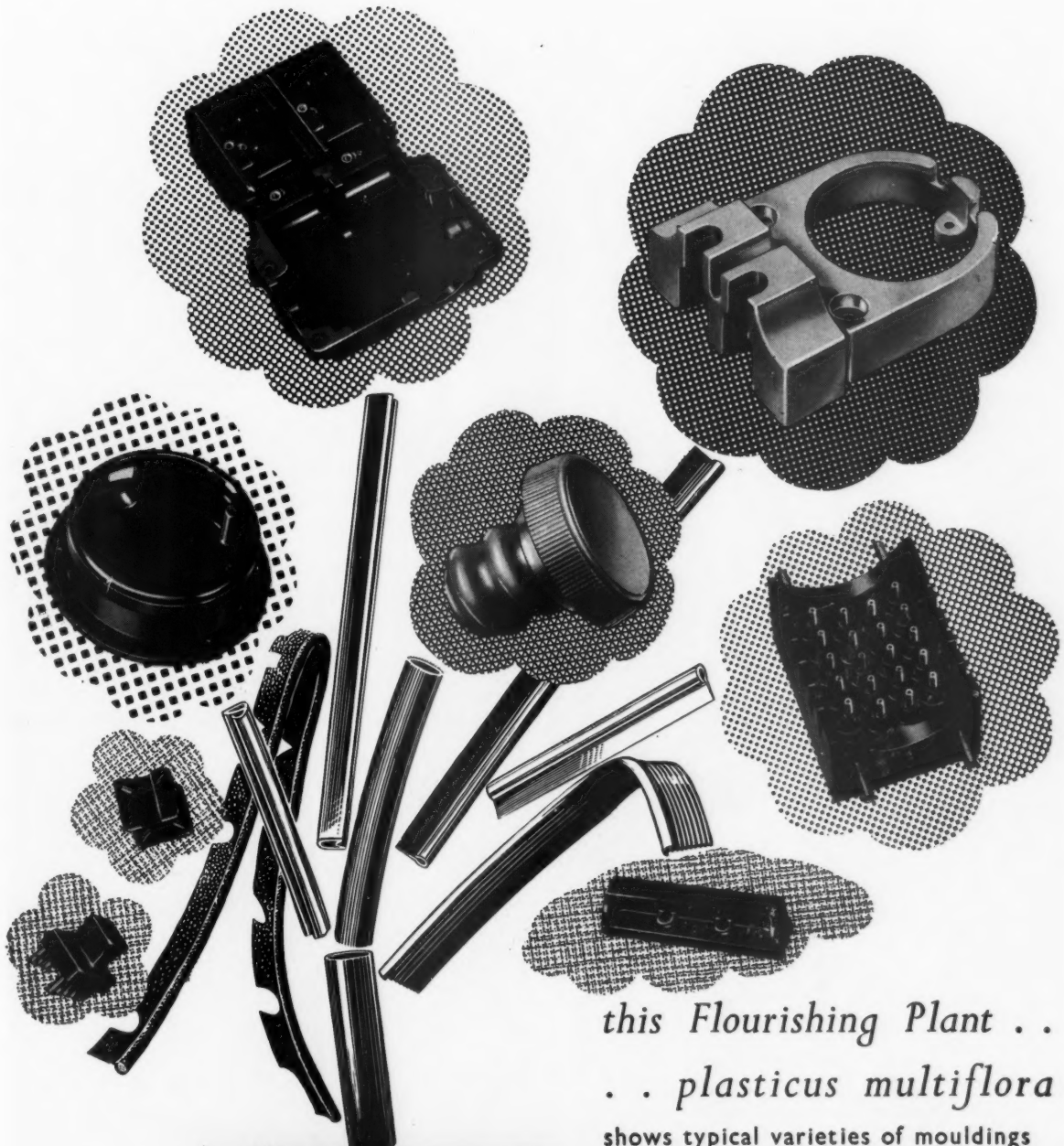
DALLOW LAMBERT

DUST CONTROL EQUIPMENT FOR INDUSTRY

There's a resident Dallow Lambert man in your area

DALLOW LAMBERT & COMPANY LIMITED, THURMASTON, LEICESTER

CDC 72



this Flourishing Plant . .

. . plasticus multiflora

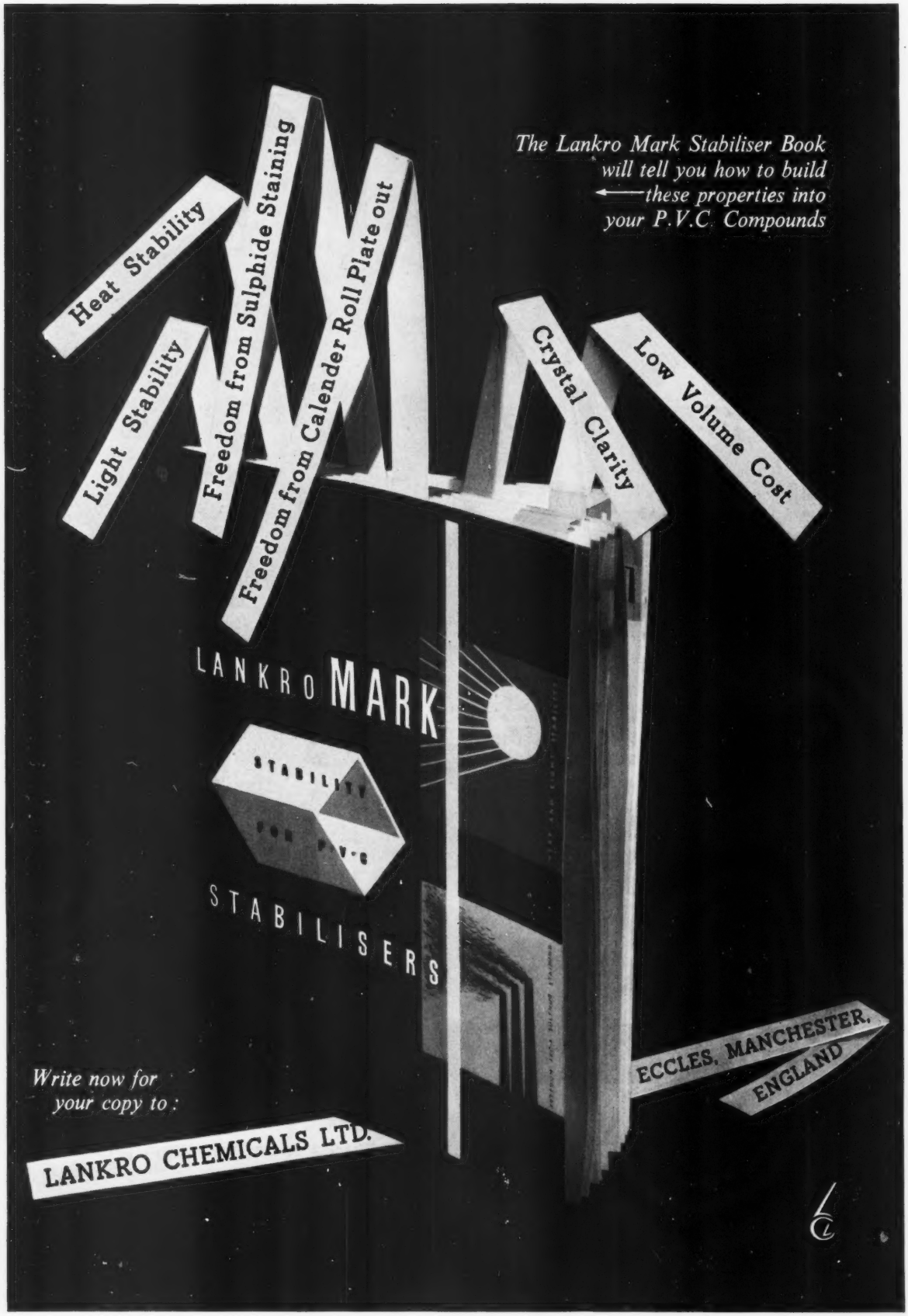
shows typical varieties of mouldings produced from blueprint seeds at our factory in Coventry.

Quantity production available for mouldings, pressings, extrusions for all industries at down to earth prices.

COVENTRY MOTOR AND SUNDRIES CO. LTD.

SPON END COVENTRY • TEL: COVENTRY 40363-4

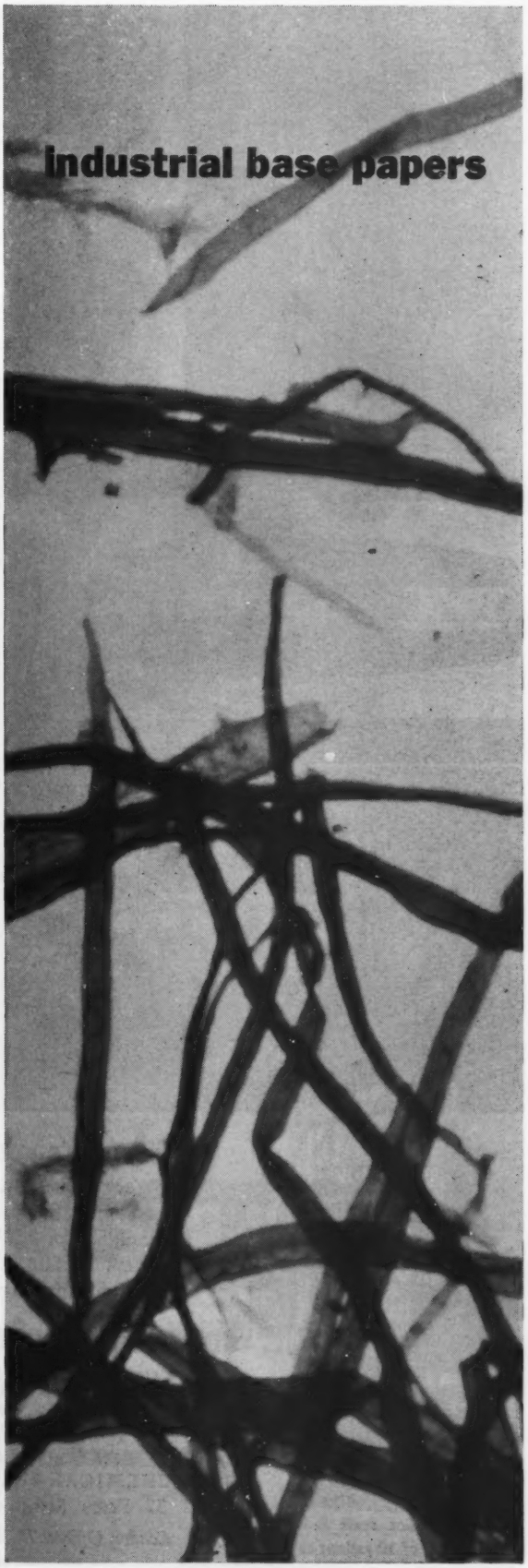
582

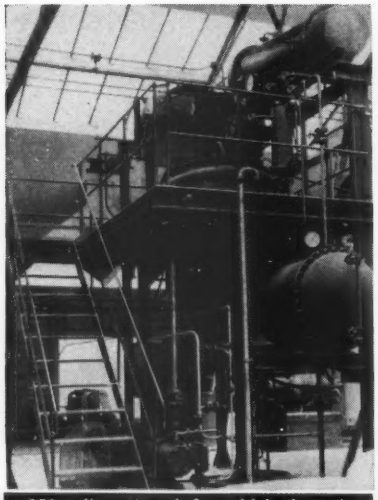

The Lankro Mark Stabiliser Book will tell you how to build these properties into your P.V.C. Compounds
Heat Stability
Light Stability
Freedom from Sulphide Staining
Freedom from Calender Roll Plate out
Crystal Clarity
Low Volume Cost
LANKRO MARK
STABILISERS
ECCLES, MANCHESTER, ENGLAND
Write now for your copy to :
LANKRO CHEMICALS LTD.

Specialized purpose made papers for industrial use require a rigid quality control and papermaking skill during manufacture. With the great adaptability provided by the 52 papermaking machines backed by a qualified and experienced Research Organization Wiggins Teape lead the field in the development and manufacture of a wide variety of industrial base papers, including papers for the plastic, filter, abrasive and leathercloth trades. If you think that paper might help in the manufacture of or become a raw material for your products, consult WIGGINS TEAPE first—they already know most of the answers

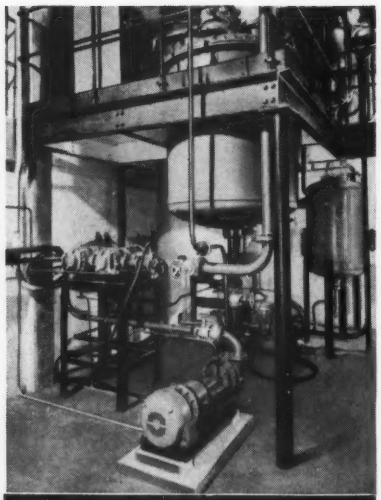
THE WIGGINS TEAPE GROUP

Gateway House 1 Watling Street London EC4 City 2020

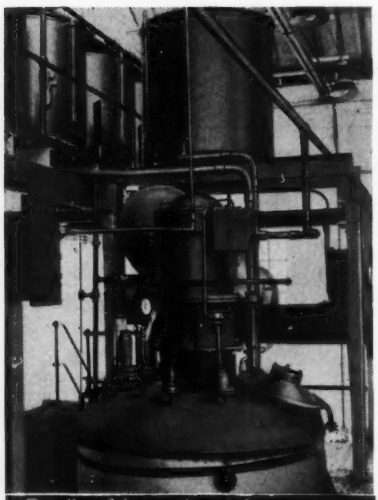




250 gallon phenol formaldehyde resin distillation plant.



Alkyd resin plant in a large paint factory.



Details of large phenol formaldehyde resin making kettle.

THE MITCHELL ORGANISATION

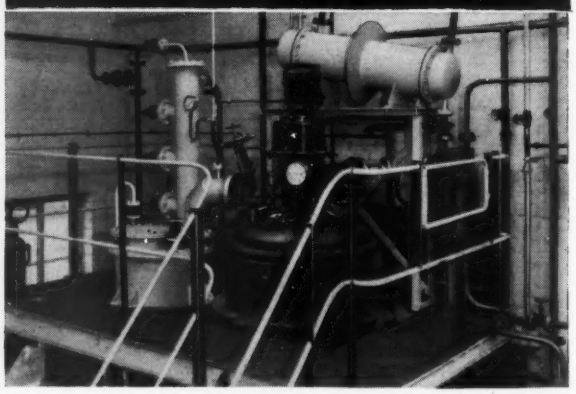
Specialise in

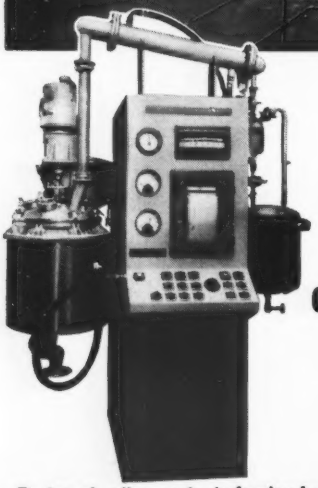
RESIN DISTILLATION PLANTS

with electric induction heating ★ fluid heating and cooling ★ high pressure steam heating ★ steam ★ Gas ★ Oil

Large installation for the production of alkyd resins.

Electric induction heated resin plant of 100 gallons capacity





Packaged pilot scale induction heated resin plant of 10 gallons capacity.

We invite you to consult us with your enquiries for

Re-actors, kettles, autoclaves of modern design. Fluid agitating and mixing equipment for resins, varnish, paints etc. Industrial drying equipment for moulding powders and curing resins etc. Continuous impregnators for papers or fabrics for production of laminates. Sparkler horizontal plate filters for filtering resins, varnish, oils, chemicals.

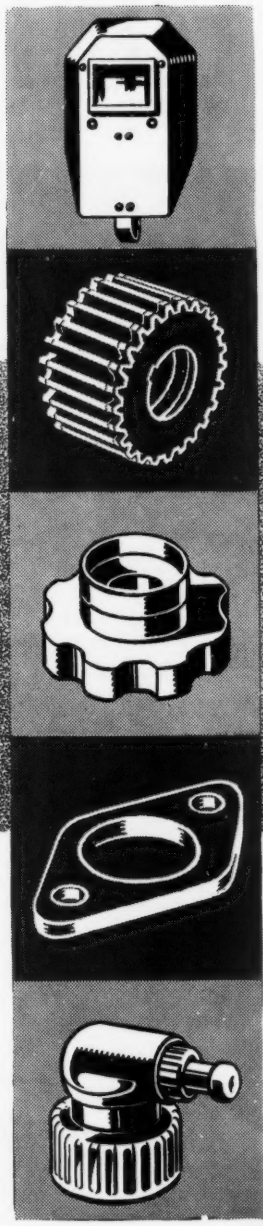
COMPLETE RESIN MAKING PLANTS DESIGNED AND BUILT FOR

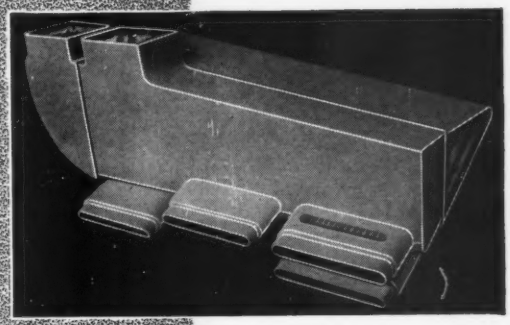
Alkyds ★ Polyester resins ★ Phenol Formaldehyde resins ★ Urea formaldehyde ★ Melamine resins ★ Epoxy resins

Write for details to:

CHEMICAL ENGINEERING DIVISION OF L.A. MITCHELL LIMITED
37 Peter Street, Manchester 2. Tel. Blackfriars 7224/7 and 7824/7
London Office: 73 Basinghall St., London, E.C.2 Tel. METROPOLITAN 8321

Multi-Purpose
MOULDING MATERIAL
for every industrial need





An internally lagged duct made of "Durestos" resinated Asbestos Felt Moulding Material for the air conditioning system in the Bristol "Britannia" airliner.

"Durestos" is the brand name of a group of moulding materials for applications requiring a high strength component. They are all intimate blends of asbestos and thermosetting resins, and are readily available in three forms, felt, flock and powder. Typical examples of applications are featured left and above.

TURNERS **DURESTOS** REGD

RESINATED ASBESTOS FELT FLOCK & POWDER MOULDING MATERIALS

TURNER BROTHERS ASBESTOS CO. LTD. ROCHDALE ENGLAND

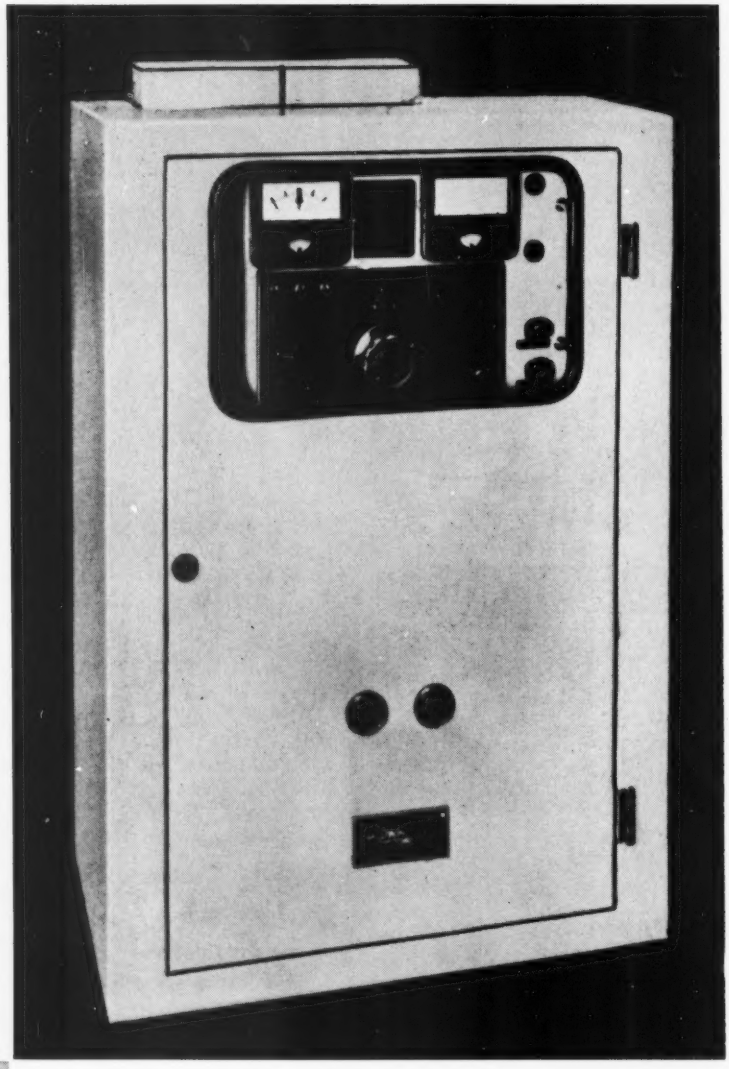
A MEMBER OF THE TURNER AND NEWALL ORGANISATION

dm TA 96

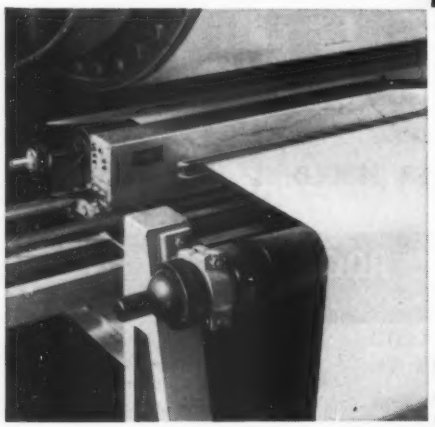
BALDWIN NUCLEONICS

'ATOMAT' NON-CONTACT THICKNESS GAUGES

for materials in continuous production



More and more industries are finding that Atomat Nucleonic Thickness Gauges are the effective answer to many problems and difficulties. Apart from being accepted as the standard measuring instrument in the paper, metal rolling and rubber and plastics industries, the Baldwin Atomat has been successfully applied to measuring coatings of selenium on aluminium, coatings of paints and lacquers, density of wood chips, coatings of grit on abrasive papers, and padding and resin impregnation in textiles — many potential applications still remain.



Now available with automatic standardisation and control, the versatile Baldwin Atomat could be the answer to *your* problems. Full technical details are available in Brochure No. L-124 — write *now* for your copy.

BALDWIN INSTRUMENT COMPANY LTD

BROOKLANDS WORKS · DARTFORD · KENT · DARTFORD 2948

One of the Harper Group of Companies

B62

fanfare

for

DEEP DRAWING
Cellastine
TRADE MARK
ACETATE SHEETING

BLISTER PACKS–new note in vision packaging

Vacuum formed Cellastine blister packs 'hug' the product, give top quality and *maximum* visual display with sure protection, especially from shop or travel soiling. Ideal for mass production, Cellastine gives great depth of draw and the fine 'finish' which makes these new blister packs sure sellers.

The Celanese Technical Advisory Service, with its unrivalled experience, is freely available to assist you with any special packaging problems you may have. Write to Department P.L.2.

+

Goldentone instruments and blister pack made by Thames Valley Moulders for Selcol Products Ltd.

PLASTICS DIVISION, BRITISH CELANESE LTD, Hanover Square, London, W.1. **MAYfair 8000**

RYAS-8

C

PURPLE

IN THE SERVICE OF COLOUR

The dye PURPLE was originally prepared from the fish Purpura —hence its name, and at the time of the Roman Emperors it was the most expensive dye to be obtained and therefore was only worn by the Caesars, Imperial V.I.P's and wealthy Merchants. Thus it was regarded as a symbol of affluence so that the phrase "Born in the purple" was not without its direct meaning.

Today, however, moderately priced Purples—in Opaques and Mottles—are to be found in the wide range of

FERGUSON'S WOOD-FILLED UREA

Moulding Powders . . . powders that adhere to their original characteristics from batch to batch and produce the most admirable plastic mouldings of supremely predictable colour.

YOU'RE RIGHT WITH 'NESTORITE'

JAMES FERGUSON & SONS LTD.,

PRINCE GEORGE'S RD., MERTON ABBEY, LONDON, S.W. 19.
Tel: MITCHAM 2283 (5 lines) · Grams: NESTORIUS, SOUPHONE, LONDON

A. S. HARRISON & CO. (PTY) LTD. 85 Clarence St., Sydney, Australia. 120 Wakefield St., Wellington, New Zealand.
ANDRE, BERJONNEAU 134 Avenue de Villiers, Paris 17, France.
JOSE DELCLOS MOLLERA Angel Baixeras, 39 Barcelona (2), Spain.
EINAR HOLMARK 19 Gl. Kongevej, Copenhagen V, Denmark.
ALLMANNA HANDELSAKTIEBOLAGET Stockholm, Sweden.

"SKYLON" POLYTHENE HOT WATER BOTTLES

FIBRENYLE LIMITED
157 DUKES ROAD
WESTERN AVENUE, LONDON, W.3
ACORN 5073-4

Here you see the new range of "SKYLON" polythene hot water bottles—get one for your wife, they're obtainable from Chemists everywhere!—but, the real object in showing them here is to illustrate once again how "SKYLON" polythene "know-how" and use of colours can make the most plebeian objects into a most attractive selling line.

Even the Cat loves it!

If we can do this with a hot water bottle we can obviously be of help in planning and producing your product in polythene. Ask to see a Technical Representative.

JACW/P/1.

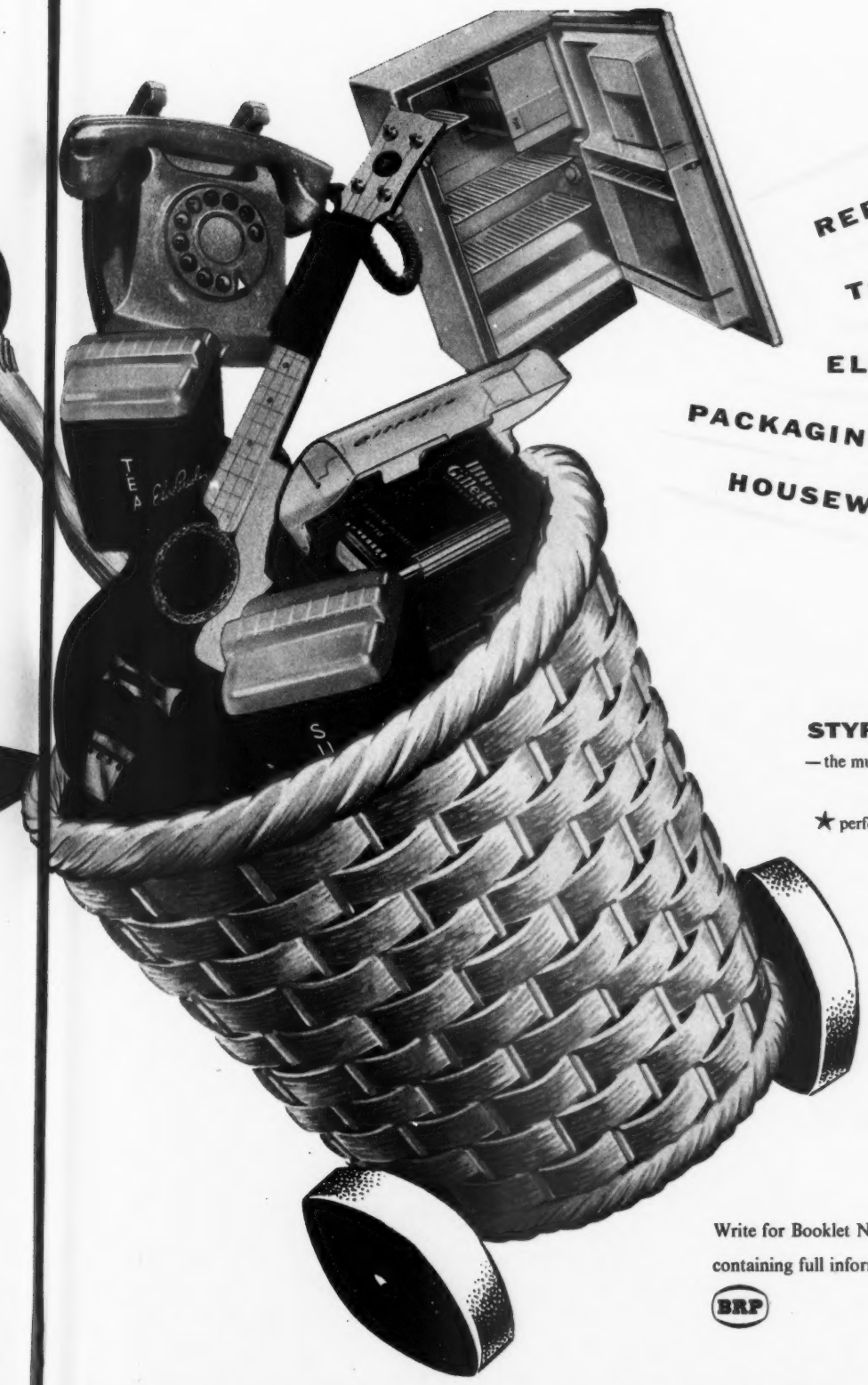
a supermarket — as big as Britain

for products made with STYRON Polystyrene

There are 12¼ million married women in Britain . . . They provide an eager market for the best in plastics made with the brightest name in polystyrene. Styron* offers designers and manufacturers a material which has achieved, time and again, contemporary styling combined with toughness, pleasing colour and functional elegance. In packaging and refrigerator parts, electricals, toys and housewares – there is no limit to what can be made with Styron. No limit to the future of this most versatile of modern plastics.

* Trade mark of the Dow Chemical Co. USA. Manufactured by Distrene Limited

Sole Selling Agents **BRITISH RESIN PRODUCTS LIMITED**



REFRIGERATION

TOYS

ELECTRICALS

PACKAGING

HOUSEWARES

STYRON

— the multipurpose polystyrene

★ performs well at low temperatures

★ excellent electrical properties

★ crystal clear or unlimited range of colours

★ light; tough; non-greasy to touch

★ odourless; non-toxic; non-rusting

Write for Booklet No. 200
containing full information about Styron

BRP

Sales and Technical Service Devonshire House Piccadilly London W1 Hyde Park 0151

THE MOST COMPREHENSIVE RANGE IN THE COUNTRY!

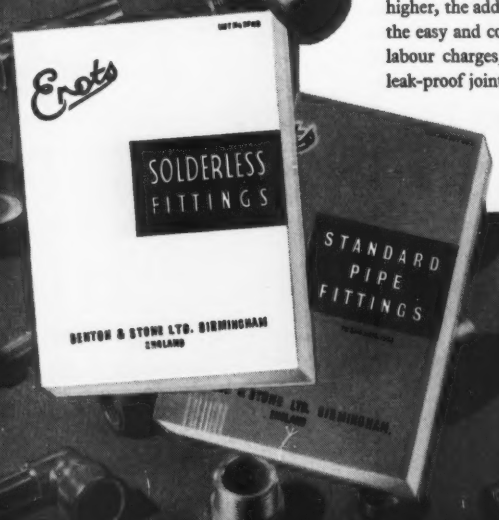
Enots SOLDERLESS UNIONS

for the connecting of pipe-lines for use with fluids, gases, compressed air and hydraulic circuits

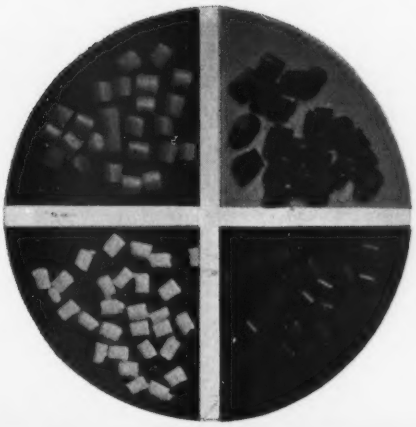
100% LEAKPROOF!

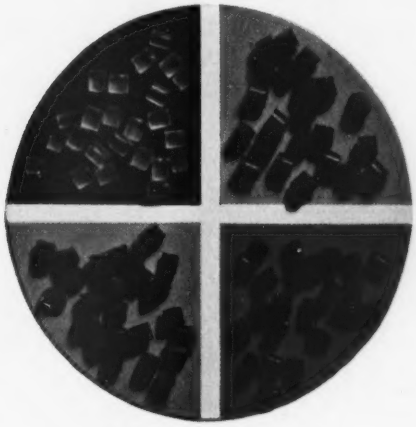
The indisputable advantages of the brass solderless fitting as a means of connecting copper pipe lines, over the older, unsatisfactory method of employing iron pipes and screwed fittings with all the troubles of rusting and leaky joints, are well recognised and, although first cost of material is higher, the additional expense is more than saved by the easy and convenient fitting and the economy in labour charges, apart from obtaining 100 per cent. leak-proof joints with Enots Solderless Fittings.

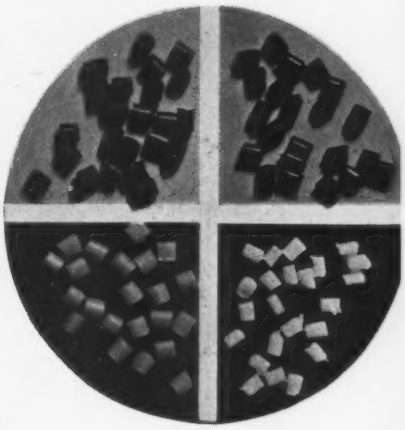
Write NOW for Catalogues S.F. 158 and S.P.F. 657



BENTON & STONE LTD., ASTON BROOK STREET, BIRMINGHAM 6. Telephone: ASTon Cross 1905







akulon

the versatile Nylon material

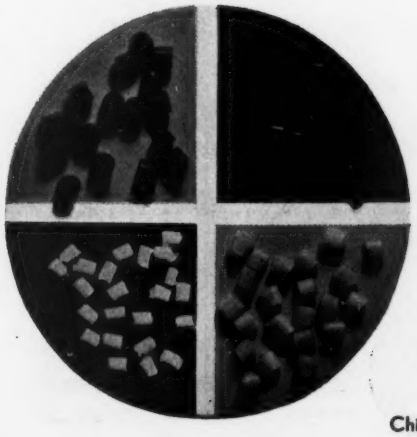
MOULDING POWDERS,

in a wide variety of formulations for *injection moulding*, including the new K 2 S-compound, developed for faster and easier moulding. Also formulations for *extrusion*.

RODS,

up to 6" Φ and suitable for *machining*.

Full technical advice available



BX PLASTICS LIMITED

Chingford, London, E 4, Telephone: Larkswood 5511

Distributors for the United Kingdom and Ireland of

ALGEMENE KUNSTZIJDE UNIE N.V.
Plastics Department Arnhem (Holland)

Do it well . . .
see RCL *about . .*

POLYESTER RESINS
of the
WRESINOL 11000 GROUP
for wet lay-up
and matched die moulding.

Resinous Chemicals Limited **RCL** **BLAYDON, COUNTY DURHAM**

RCL 59

CELLIDOR* "B"

The only European Butyrate Moulding Granules

* *Registered Trade Name*

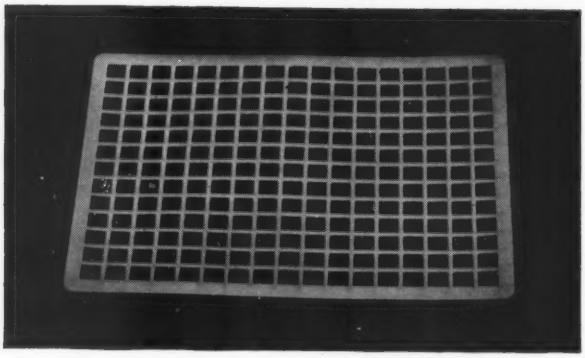
*Distributed, by arrangement with J. M. Steel & Co. Ltd., by:—

R. H. COLE & COMPANY LTD
2 CAXTON STREET · WESTMINSTER · LONDON · SW1

Telephone : ABBey 3061 (10 lines)
Telex No. 23864

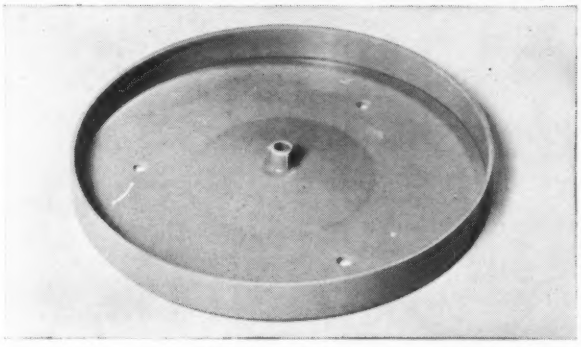
Telegrams : GERATOLE, LONDON, TELEX
Cables : GERATOLE, LONDON

D

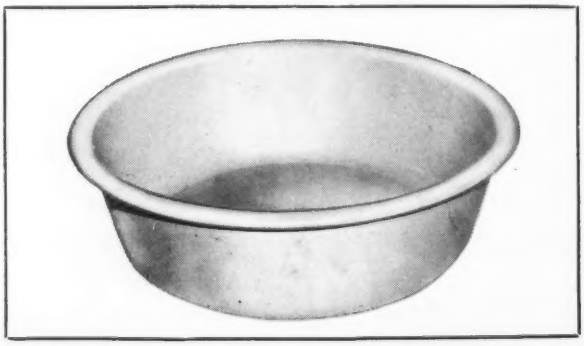


6½-oz. Polystyrine sink-drainer, 17" x 12", cast on a standard, 10D-8, 8-oz. Herbert Reed-Prentice with Dykehouse Pre-plasticiser. Cycle time overall: 19 seconds.

28-oz., 231-square-inch, Polystyrine tray, cast on an 8-10 Windsor, with Dykehouse Pre-plasticiser. Cycle time: 42 seconds.



9½-oz., nylon gramophone turntable, cast on a standard, 10D-8, 8-oz., Herbert Reed-Prentice, with Dykehouse Pre-plasticiser. Cycle time: 22 seconds.



OVER 90 CYCLES PER HOUR! 15-oz., 197-square-inch, Polythene bowl moulded on a standard 8-oz. machine with Dykehouse Pre-plasticiser. Material saved by Super Therm metering system: 1½-oz. per shot.

DYKEHOUSE PRE-PLASTICISERS WILL GIVE YOU . . .

1. **THINNER WALLS . . .**
2. **LONGER FLOWS . . .**
3. **BIGGER CASTING AREA (231 SQ. INS ON 8-10 WINDSOR MACHINES) . . .**
4. **GREATER ECONOMY OF MATERIAL . .**

. . . THAN ANY OTHER MACHINE IN THE WORLD

DYKEHOUSE PRE-PLASTICISERS DO JOBS NO OTHER MACHINE IN THE WORLD WILL DO

DYKEHOUSE PRE-PLASTICISERS . .

YOU CANNOT AFFORD TO IGNORE THE PROVED ADVANTAGES OF DYKEHOUSE PRE-PLASTICISERS

Come and see them for yourselves!

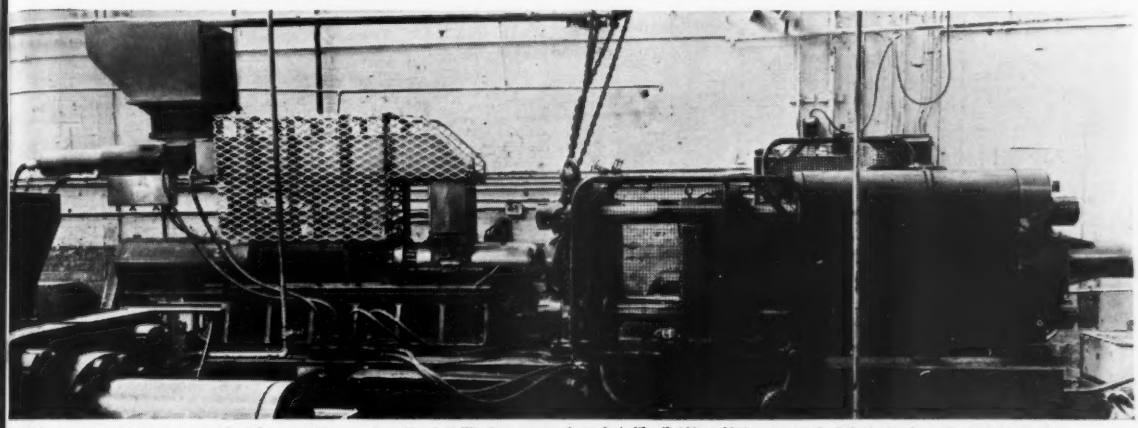
THESE ARE THE POINTS NO MOULDER CAN AFFORD TO IGNORE:

1. **Dykehouse Pre-plasticisers need no more floor space**
2. **Dykehouse Pre-plasticisers need no extra power plant**
3. **Dykehouse Pre-plasticisers need no extra water supply**
4. **Dykehouse Pre-plasticisers need no extra labour**

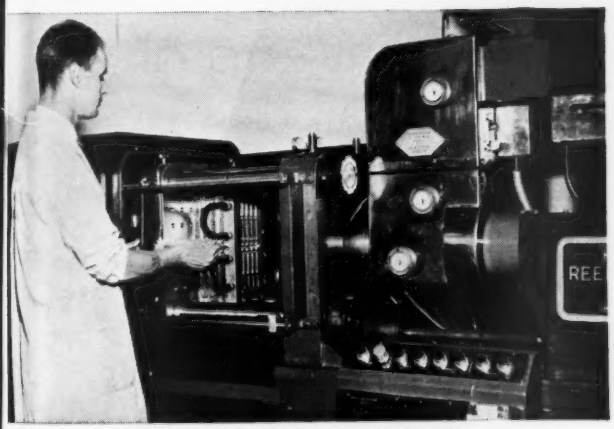
BUT . . . Dykehouse Pre-plasticisers can boost your output of finished products by more than 35%!

Several of our customers have ordered complete plant conversions from us. It's a wise move! Why spend precious pounds to buy new plant when our low-cost conversion units will do a better job?

DEMONSTRATIONS. At our demonstration centres at Hayes, Middlesex, and Stockport, Cheshire, we shall be glad to show you what Dykehouse Pre-plasticisers can do. Please write or phone to Hayes, to arrange the demonstration you would like to see.



With Dykehouse Pre-plasticisers, standard 8-oz. machines such as this 8-10 Windsor can produce shots like the 29-oz., 231-square-inch, Polystyrine tray illustrated opposite.



A Herbert Reed-Prentice 4-6 in operation at our Hayes demonstration centre.

DYKEHOUSE SELF-CONTAINED INJECTION UNITS CONVERT YOUR *COMPRESSION PRESSES* TO EXTRA-EFFICIENT INJECTION MOULDING MACHINES

MODEL 30 for use with 250-350 ton down-stroke press
Oz. per shot: 30 (Polythene)
Lb. per hour: 100
Casting area: 175 sq. in.

MODEL 120 for use with 550-650 ton down-stroke press
Oz. per shot: 120 (Polythene)
Lb. per hour: 250
Casting area: 425 sq. in.

MODEL 40 for use with 450 ton down-stroke press
Oz. per shot: 60 (Polythene)
Lb. per hour: 150
Casting area: 300 sq. in.

MODEL 200 for use with 800-1000 ton down-stroke press
Oz. per shot: 200 (Polythene)
Lb. per hour: 350
Casting area: 600 sq. in.

MODEL 400 for use with 1500-2000 ton down-stroke press
Oz. per shot: 400 (Polythene)
Lb. per hour: 550
Casting area: 1200 sq. in.

COOKE & DYKEHOUSE PLASTIC MACHINERY CO. LTD

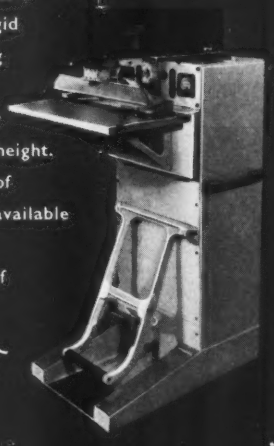
116 DAWLEY ROAD, HAYES, MIDDLESEX. HAYes 5227/9

. . . . YOUR KEY TO EXPANSION WITH EXISTING PLANT

for quality P.V.C. goods and garments

PEDAL OPERATED PLASTIC SHEET WELDER

A 1½ kW welder of up-to-the-minute design. Refinements include a large detachable work table, rigid head mounting and positive adjustment for top electrode height. A wide range of accessories is available to facilitate manufacture of clothing, handbags, notecases, etc.

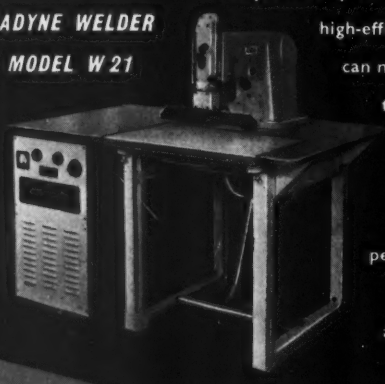


RADYNE WELDER MODEL W 1250

GENERAL PURPOSE PLASTIC SHEET WELDER

A de-luxe press welder with output smoothly adjustable up to 3 kW and surge-free, high-efficiency performance, can make a plain weld up to approximately 80" long by 1/16" wide. Features include Warerite table top, pedal lock and release for long dwell work and patented Radyne arc-limiting device.

RADYNE WELDER MODEL W 21



SPEEDIER PRODUCTION OF FANCY GOODS

RADYNE PRESS WELDER MODEL PW 50/S

The sliding loading frame of this 6 kW Radyne welder enables fast and continuous production to be maintained. One tray is loaded whilst the patterns on the other are welded. Single or dual control. It can also be used for profile welds up to 240".

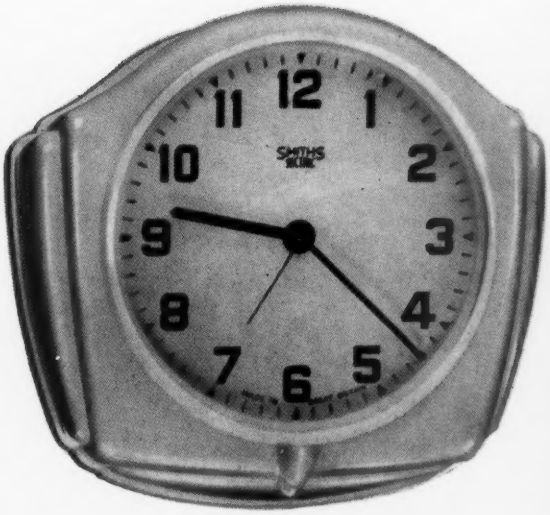
RADYNE

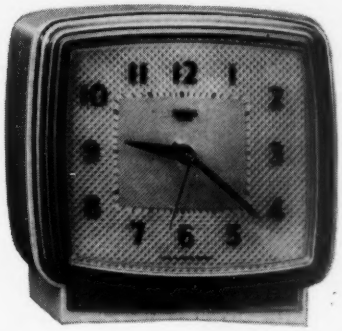
The finest range of plastic sheet welders

radio heaters ltd

WOKINGHAM · BERKS · ENGLAND · *Telephone Wokingham 1030 (6 lines)*

P109





In a matter of seconds...

SMITHS CHOSE LUSTREX

Smiths Clocks are renowned throughout the world for their good looks and reliability. And no wonder — for Smiths attach great importance to selecting the finest materials for use in their manufacture. That's why they chose Lustrex. This high-quality polystyrene could be relied upon to uphold a fine and well-established reputation.

Lustrex can help you just as it is helping Smiths. No matter what job you may have in polystyrene, there is a grade of Lustrex available to give you the best possible mouldings. Write now for more information.

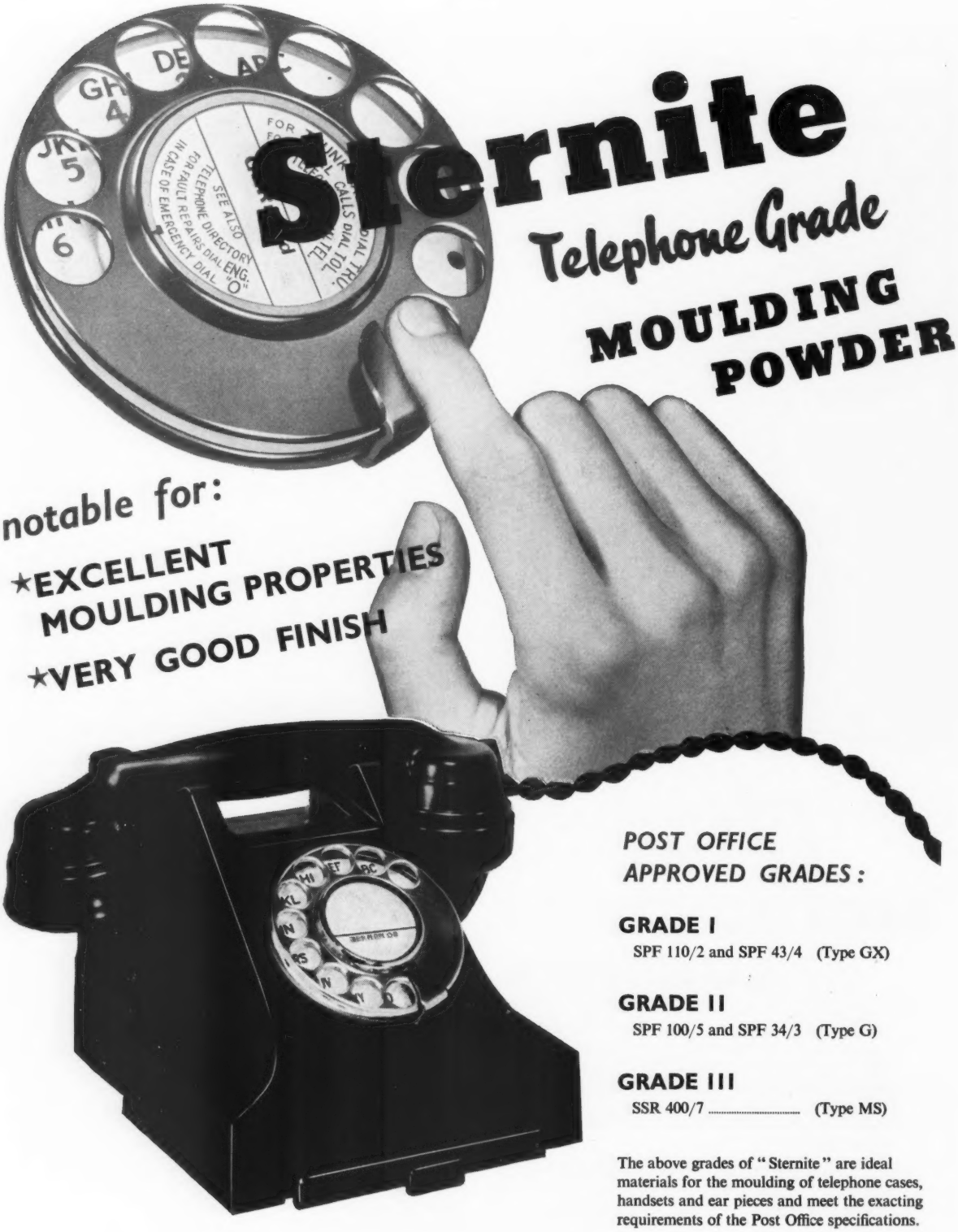
Lustrex is a Registered Trade Mark.

Monsanto chemicals and plastics help industry — to bring a better future closer

Monsanto
Reg'd.

MONSANTO CHEMICALS LIMITED, Plastics Division
544 Monsanto House, Victoria Street, London, S.W.1, and at Royal Exchange, Manchester, ...

In association with: Monsanto Chemical Company, St. Lou... U.S.A. Monsanto Canada Limited, Montreal, Monsanto Chemicals (Australia) Ltd., Melbourne. Monsanto Chemicals of India ...


Sternite
Telephone Grade
MOULDING
POWDER
notable for:
★EXCELLENT
MOULDING PROPERTIES
★VERY GOOD FINISH
POST OFFICE
APPROVED GRADES:
GRADE I
SPF 110/2 and SPF 43/4 (Type GX)
GRADE II
SPF 100/5 and SPF 34/3 (Type G)
GRADE III
SSR 400/7 ..... (Type MS)
The above grades of "Sternite" are ideal materials for the moulding of telephone cases, handsets and ear pieces and meet the exacting requirements of the Post Office specifications.

Sterling Moulding Materials Ltd.

STERLING HOUSE, 8 HEDDON STREET, LONDON, W.1. Works: Stalybridge, Cheshire.

S.22 *Phone: REGent 8641/50 Grams: Stermold, Piccy, London Cables: Stermold London.*

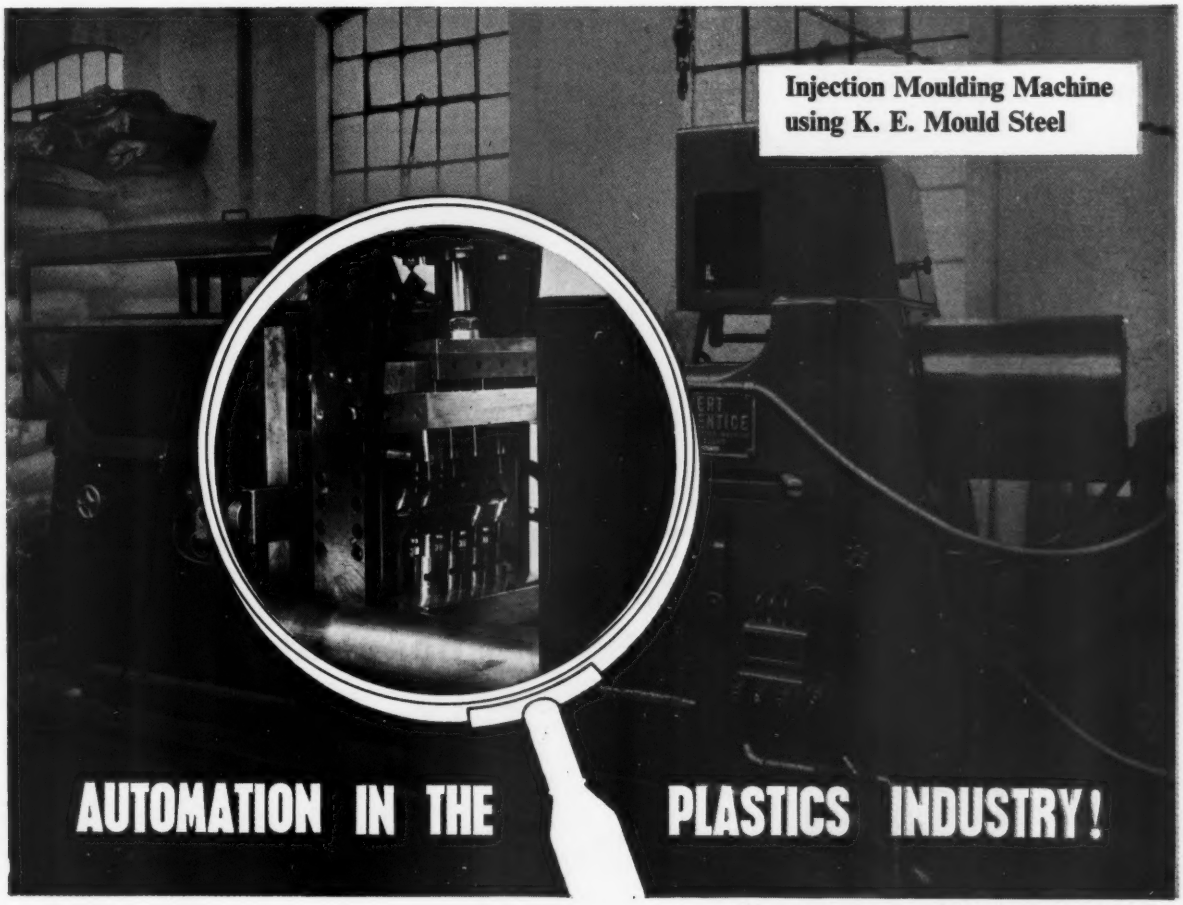


Illustration by courtesy of Wolseley Engineering Ltd.

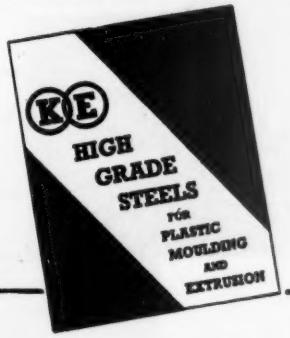
REPEAT ORDERS ARE USUALLY AUTOMATIC ONCE (KE) HIGH GRADE MOULD STEELS HAVE BEEN USED

(KE) 355 Special Nickel Chrome Molybdenum Oil or Air Hardening Mould Steel.

(KE) 961 1½% Carbon 12% Chrome High Duty Mould Steel.

(KE) A28 Special Stainless Mould Steel.

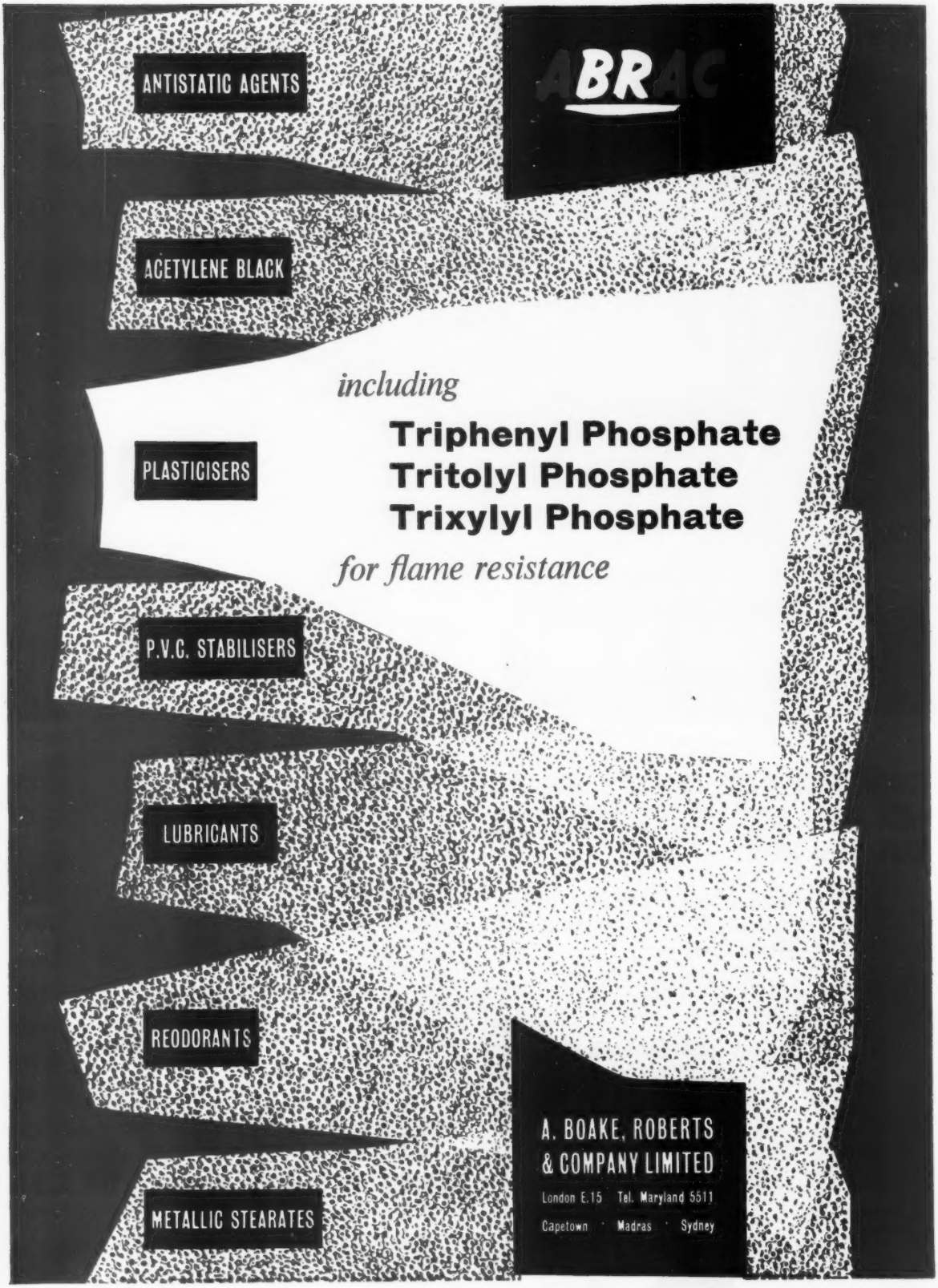
This booklet, giving greater detail, is available free on request.

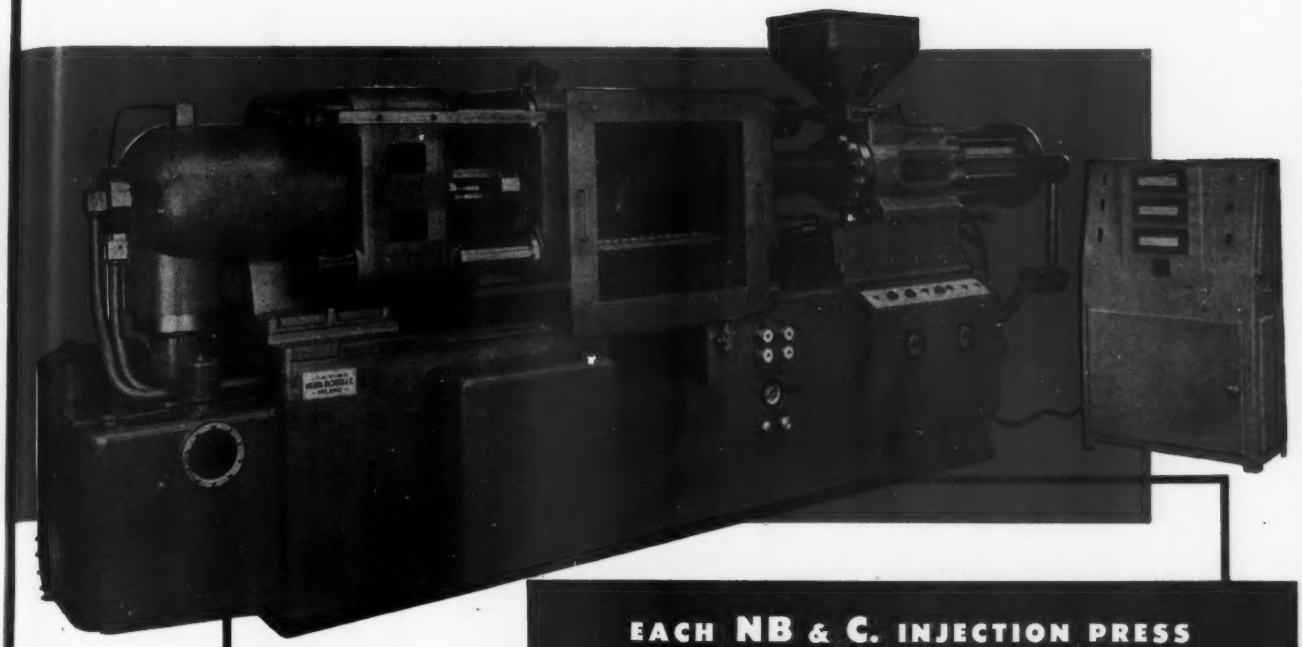


Melted to close limits of analysis. Forged with an adequate reduction of area from the ingot to ensure the maximum amount of grain distortion. Carefully annealed to give optimum machinability and grain refinement. Ultrasonically inspected prior to despatch. These factors and almost one and a half centuries of steel-making experience give our Steels a high degree of regularity and reliability. These Steels have great strength and do not distort under the high pressure of injection moulding.

KAYSER ELLISON & CO. LTD

CARLISLE STEEL WORKS · SHEFFIELD · ESTABLISHED 1825
TELEPHONE SHEFFIELD 22124


ANTISTATIC AGENTS
ABRAC
ACETYLENE BLACK
including
PLASTICISERS
Triphenyl Phosphate
Tritolyl Phosphate
Trixylyl Phosphate
for flame resistance
P.V.C. STABILISERS
LUBRICANTS
REODORANTS
METALLIC STEARATES
A. BOAKE, ROBERTS
& COMPANY LIMITED
London E.15 Tel. Maryland 5511
Capetown · Madras · Sydney



EACH NB & C. INJECTION PRESS ENJOYS TWO YEARS GUARANTEE

NB&C

INJECTION PRESSES
ENSURE FIRST-CLASS
GREAT PRODUCTIVITY
CUTTING DOWN COSTS

powerful newly-conceived, built-in oildynamic circuits

increased plasticizing capacity

higher injection rapidity

SPECIFICATIONS

model	NB 28	NB 30 Record	NB 40	NB 60 E	NB 100	NB 120 E	NB 160
injection capacity oz.	1	1 1/2	1.4	2.1	3.5	4.2	5.6
hourly plasticizing capacity lbs.	6.6	12	15.4	28.6	26.4	53	39.6

			FULLY AUTOMATIC				
model	NB 220 E	NB 360/520 E	R 01	R 02	R 6 FA	R 12 FA	R 20 FA
injection capacity oz.	7.7	13-19	0.53	0.85	2-3	4-6	7.7-11.6
hourly plasticizing capacity lbs.	75	97	7.7	7.7	29	53	75

ASK FOR LITERATURE!

NB&C

NEGRI BOSSI & C.

MILANO/ITALY - VIA BAZZINI 24 - TELEF. 235.555 - 230.512 - 235.884
CABLES NEGRIBOS MILANO

Bridge-Banbury MIXERS

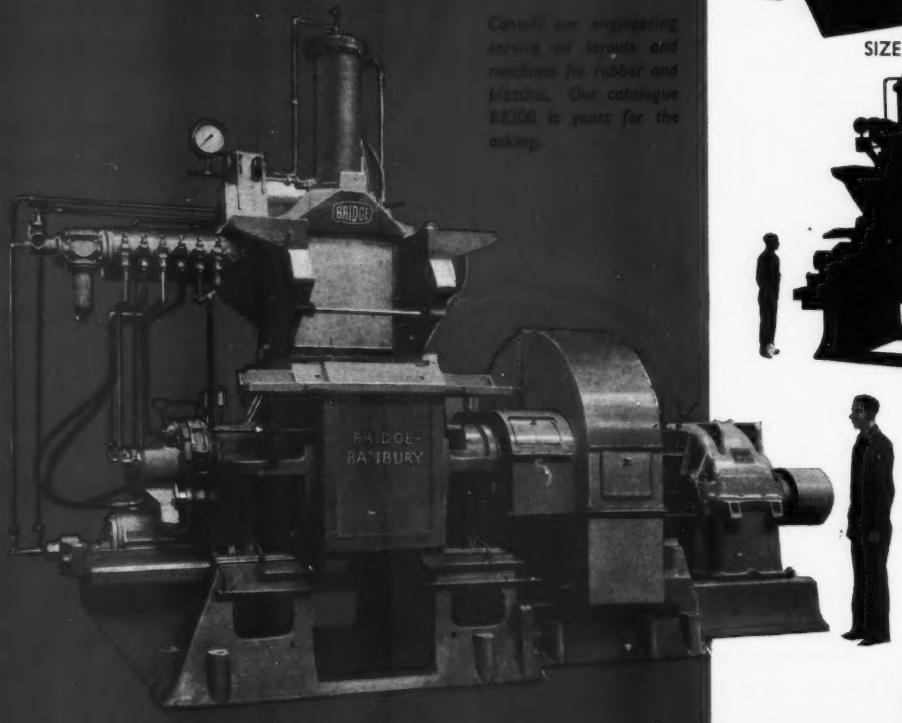
Produce the

Highest Output more quickly, more efficiently, and guarantee a more uniform and

Highest Quality mix. By minimising manual operating they produce at

Lowest Costs with the maximum degree of dependability and safety.

Consult our engineering service on layouts and machines for rubber and plastics. Our catalogue BB300 is yours for the asking.



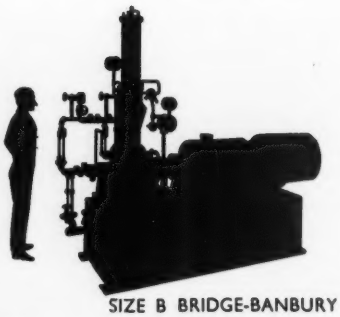
SIZE 11 BRIDGE-BANBURY

An alliance of association with Farrel-Birmingham Co. Inc. U.S.A.

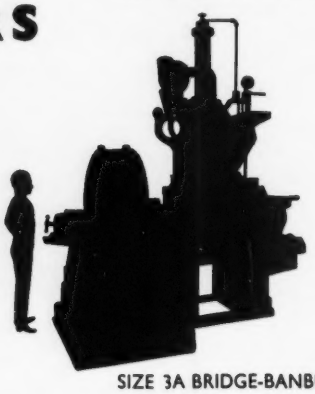
BRIDGE-BANBURY *Automation*

DAVID BRIDGE & COMPANY LIMITED

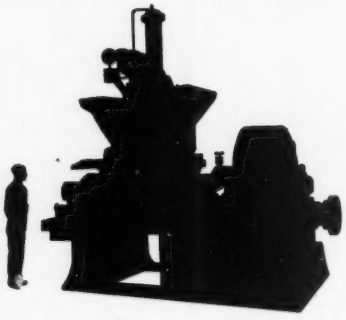
Castleton, Rochdale, Lancs. Phone: Castleton (Rochdale) 57216. Grams: Crushing Phone Castleton Lancs. London Office: Broughton House, 6, 7, 8 Sackville Street, Piccadilly, London, W.1. Telephone: Regent 7485.



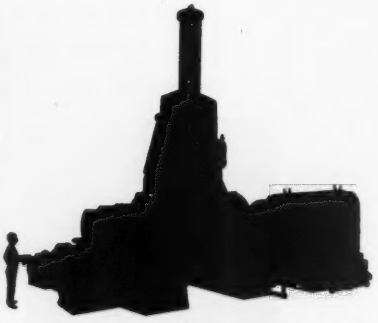
SIZE B BRIDGE-BANBURY



SIZE 3A BRIDGE-BANBURY



SIZE 9 BRIDGE-BANBURY



SIZE 27 BRIDGE-BANBURY

now from SHELL comes Carlona

Ziegler process high-density polyethylene

Compared with earlier polyethylene, Carlona is much stronger, more rigid, more heat resistant, and more resistant to chemicals and solvents.

And it is now being made in the United Kingdom in production quantities.

Carlona's enhanced qualities are such that this important new plastics material is assured of very wide acceptance and application.

The various grades have been developed to meet the needs of fabricators using injection moulding, extrusion and other thermoplastic techniques. Sample and commercial quantities can now be supplied.

Further information from

SHELL CHEMICAL COMPANY LIMITED

In association with Petrochemicals Limited and Styrene Products Limited

Divisional Offices:

LONDON	Norman House, 105-9, Strand, W.C.2. Tel: TEMple Bar 4455.
MANCHESTER	144-6, Deansgate. Tel: Deansgate 6451.
BIRMINGHAM	14-20, Corporation Street, 2. Tel: Midland 6954-8.
GLASGOW	124, St. Vincent Street, C.2. Tel: Central 9561.
BELFAST	35-37, Boyne Square. Tel: Belfast 26094.
DUBLIN	53, Middle Abbey Street. Tel: Dublin 45775.

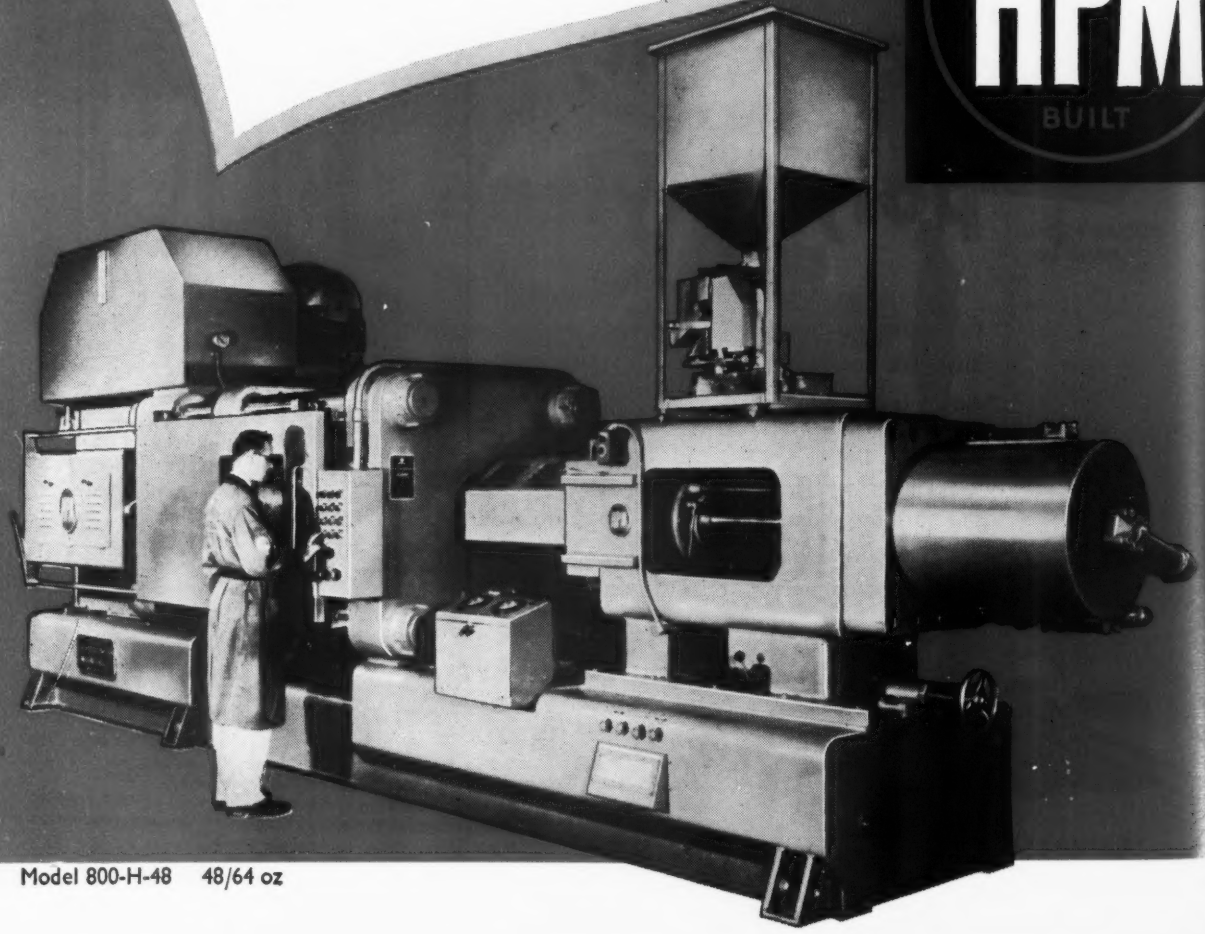
"CARLONA" is a Registered Trade Mark

TH.1

Dependable moulding

- Rapid action H.P.M. straight-line hydraulic mould clamp, quick interchange of moulds with automatic adjustment for thickness.
- Full ejecting pressure secured at any point of the return stroke. Increased daylight and stroke for producing deep parts.
- High speed injection unit increases plasticizing rate, and fast injection plunger speed reduces cycle times.
- Accurate compensating weigh feeders, and an extra timer permit double feeding of material for large capacity shots.
- Dual injection pump for two-speed injection or dual pressure injection, as desired.
- Silent pumps supply hydraulic power for maximum clamping pressure and operation of clamp and injection rams.
- All hydraulic components are readily accessible. A minimum of pipe lines permits easy interchange of valves without interference.

BRITISH **HPM** BUILT



Model 800-H-48 48/64 oz

at lower cost per shot

Step up production with H.P.M. machines — the fastest injection moulders producing thermo-plastic parts at lower cost per shot than any other machines of comparable size.

They are fully automatic "all-hydraulic" machines possessing many outstanding features providing faster cycle times, powerful clamping and easy set-up, accurate material feed and high plasticizing capacity.

In addition, they are economical with labour, floor space and material, and are dependable too. The machines range in size to meet every moulding need, and each unit is backed by over seventy years' specialist service.

PLASTICS INJECTION MACHINES

SPECIFICATIONS

	Model 300-H-12	Model 400-H-20	Model 800-H-48
Volume moulded per shot (cu. ins.)	20	34	81
Weight moulded per shot (ozs.)	12	20	48
A prepacking or double stroke feed (ozs.)	16	28	64
Plasticizing capacity (lbs./hour)	135	200	300
Rate of injection (cu. ins./second)	16	17·3	40
Size of die plates	30" x 33"	36" x 42"	55" x 55"
Space between bars	17" x 20½"	21" x 27"	36½" x 36½"
Mould opening stroke	20"	28"	38"
Maximum die space	30"	40"	55"
Maximum die space with spacer	26"	34"	47"
Minimum die space	10"	15"	20"
Minimum die space with spacer	6"	9"	12"
Mould locking force (U.S. tons)	300	400	800
Mould locking force (long tons)	268	360	715
Capacity of hopper (lbs.)	100	100	350
Power consumption of heating units when plasticizing to full capacity (kW.)	21·8	35·4	37·6
Motor required	40 h.p. nominal	50 h.p. nominal	100 h.p. and 20 h.p. nominal
Shipping weight (long tons)	9·8	17·5	33·5
Overall length and width	18' 6" x 5' 5"	20' 6½" x 5' 7"	28' 3" x 7' 1"

All injection capacities specified above are for general purpose polystyrene.

Details of other H.P.M. plastics injection machines on application.

WICKMAN LIMITED

FACTORED MACHINE DIVISION, FLETCHAMSTEAD HIGHWAY, COVENTRY

Make me a million

Derwent Plastics receive orders like this with the utmost *sang-froid* (which is French for one's blood running cold). They take orders for a hundred-off with equal willingness—and the hundreds, and the millions, shape up to their models with absolute precision. So many headaches, so much capital expenditure, and so much production cost, are saved by Derwent Plastics for their clients, that in the long run, there's no doubt that Derwent *do* make them a million!

Precision moulding by

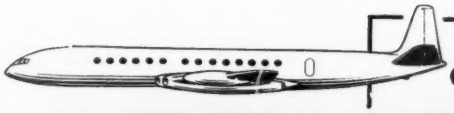
Derwent Plastics Ltd

STAMFORD BRIDGE · YORK
Telephone: Stamford Bridge 294

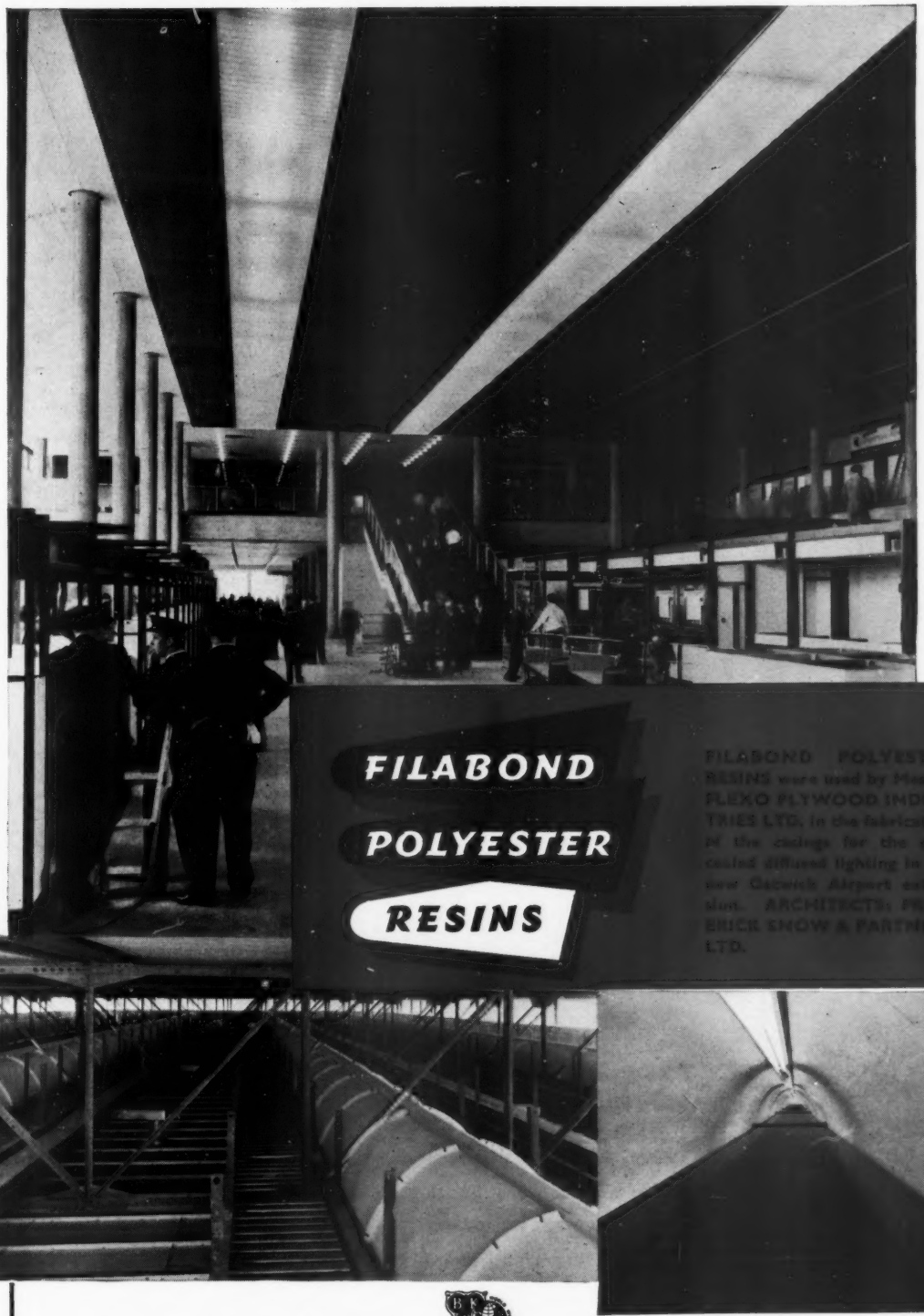
PLEASE HELP PLASTICS

DERWENT PRECISION MOULDINGS

ndh 10717d



GATWICK AIRPORT



FILABOND POLYESTER RESINS

FILABOND POLYESTER RESINS were used by Messrs. FLEXO PLYWOOD INDUSTRIES LTD. in the fabrication of the ceilings for the concealed diffused lighting in the new Gatwick Airport extension. ARCHITECTS: FREDERICK SNOW & PARTNERS LTD.

BECK KOLLER

BECK KOLLER & Co. (Eng.) LTD · BECKACITE HOUSE · SPEKE · LIVERPOOL 24

Associate Works: Reichhold Chemicals Inc., Detroit, U.S.A.

Sole Selling Agents:

JAMES BEADEL & CO., LTD Head Office: BECKACITE HOUSE · SPEKE · LIVERPOOL 24 London Office: 110 Cannon Street, E.C.4

INDULGING IN FLIGHTS OF FANCY?

Castles in the air are all very well in their place, but when it's a question of who to entrust with the supplying of your injection moulding or extrusion materials it's as well to be more down-to-earth. We, at Kleestron, have a reputation for looking a polystyrene problem firmly in the eye and solving it—and we've solved plenty, probably your own particular one. Why not ask us—if we don't have the answer we'll find it.

Write or 'phone

Kleestron Limited

WEST HALKIN HOUSE · WEST HALKIN STREET · LONDON S.W.1 · TELEPHONE: SLOane 0866

Kleestron make a comprehensive range of general polystyrenes and impact materials—and will gladly supply technical details, prices, etc.

D.M.C.

Handles, and parts for
Washing Machines,
Motor Cars, Refrigerators,
and Electrical Accessories

VACUUM FORMING

Trays for catering · Boxes
Point of Sale Display
Factory Work Boxes
Refrigerator Mouldings

STREETLY PLUS

POLYESTER/ GLASS FIBRE

Typewriter Carrying Cases
Washing Machine Tubs
Water Heater Parts
Safety Helmets · Trays

THIN WALL

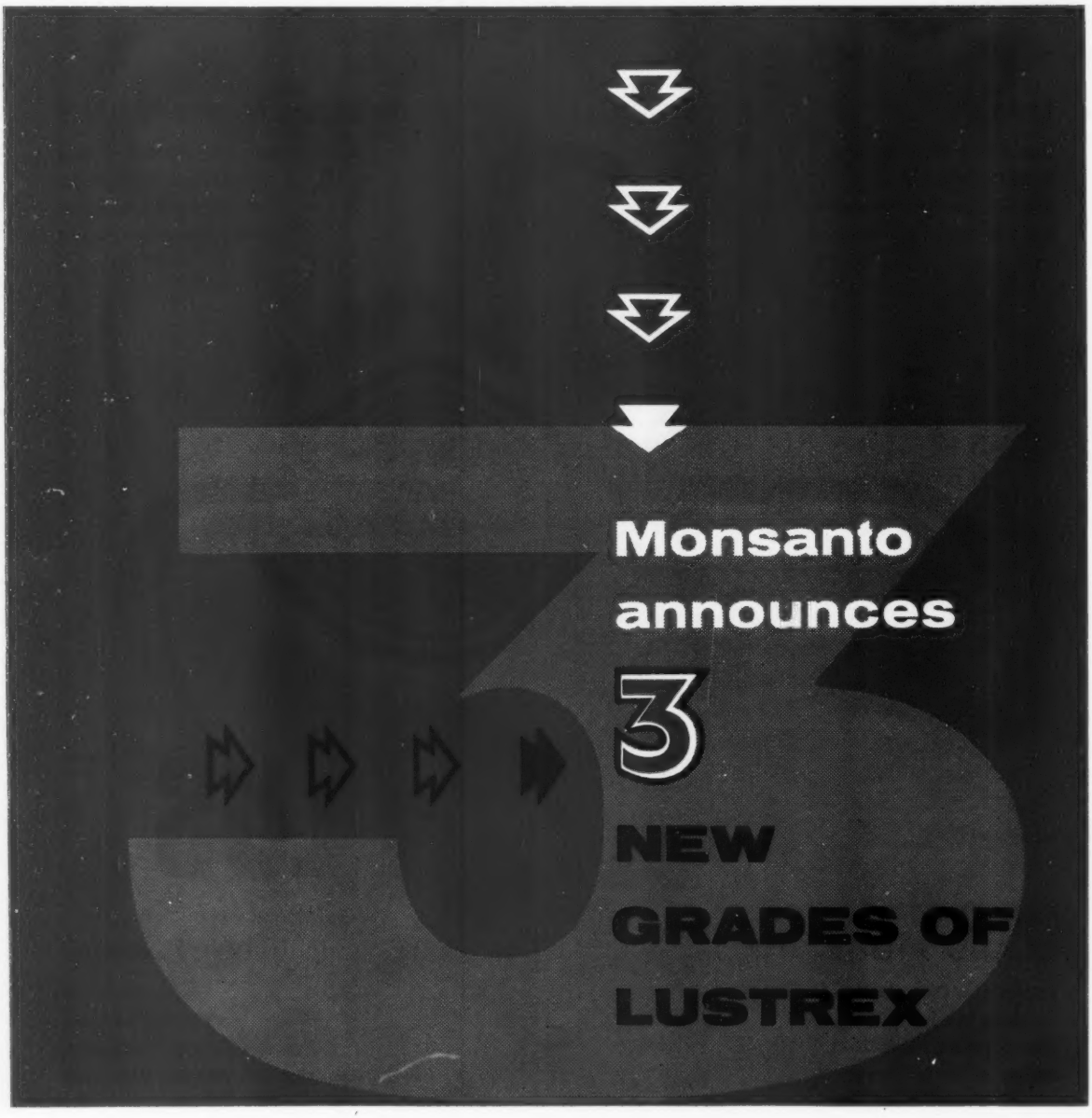
Ice Cream Tubs
Soft Drink Beakers
Pharmaceutical Containers
Tablet Dispensers · Expendable Packages

Streetly—the first moulders in Britain to re-equip throughout with auto-control presses—take a further step forward with the introduction of these valuable new services. For each service the most modern equipment obtainable has been installed and, after intensive development work, is now being operated on long runs. If one or more of these services can help you, get in touch with Streetly—the moulders who produce quality mouldings in quantity from any mouldable plastics material.

B·I·P

THE STREETLY MANUFACTURING CO. LTD.

STREETLY WORKS · SUTTON COLDFIELD · PHONE: STREETLY 2411



LOW-STATIC LUSTREX ends the problem of dust attraction: electrostatic charges are so reduced that unsightly dust patterns do not form. Low-static Lustrex is the ideal moulding material for counter displays . . . cosmetic containers . . . packs for consumer goods — in fact, for use wherever display appeal counts. It is available in both general purpose and toughened grades.

LUSTREX T7 is an entirely new grade of toughened polystyrene. Yet although toughened—impact strength 0·7 ft/lb. per inch of notch — it produces mouldings with a gloss almost as good as General Purpose Lustrex. Lustrex T7 is therefore ideal for use where a good surface finish has to be combined with extra strength.

LUSTREX UVL resists yellowing on exposure to ultra-violet light. It has been specially developed for the moulding of interior light fittings for use with fluorescent lighting. Compared with metal or glass, Lustrex UVL offers the special advantage of lightness in weight and ease of moulding into intricate shapes. It is available in crystal clear form or translucent white, also in colours.

These three new grades of Lustrex are further examples of Monsanto research in action — research that goes on constantly both to produce new chemicals and plastics, and to improve those you already use.

Write for more information on these new grades of Lustrex.

Lustrex is a registered trade mark.

MONSANTO CHEMICALS AND PLASTICS HELP INDUSTRY — TO BRING A BETTER FUTURE CLOSER

MONSANTO CHEMICALS LIMITED, PLASTICS DIVISION,
546 Monsanto House, Victoria Street, London, S.W.1, and at Royal Exchange, Manchester, 2
In association with: Monsanto Chemical Company, St. Louis, U.S.A. Monsanto Canada Limited, Montreal. Monsanto Chemicals (Australia) Limited, Melbourne. Monsanto Chemicals of India Private Limited, Bombay. Representatives in the world's principal cities.

Monsanto

Regd.

ELCO PLASTICS

LIMITED

PLASTIC MOULDINGS

S R B P TUBING

EXTRUSIONS

MODERN TOOL ROOM
AND
DESIGN STAFF
ON
PREMISES

DESBOROUGH PARK ROAD

HIGH WYCOMBE BUCKS

Tel.: High Wycombe 4111 (2) 3, 4 (4 lines)

TUBE LAMINATION & ENGINEERING

LIMITED

A.I.D. APPROVAL No. 69/40 · I.F.V. APPROVAL No. AV0078/53/D · A.R.B. APPROVAL No. A1/4305/56

See what BAKELITE epoxides can do

Write for this Technical Data

Here is up-to-date information on the properties and uses of the highly versatile range of BAKELITE Epoxide Resins. These remarkable thermosetting materials combine a unique range of properties of special interest to engineers and designers in the electrical, metal fabricating, foundry and plastics industries.

You are invited to write for your copy of this folder of technical data sheets now. The coupon opposite is designed for your convenience.

WHICH OF THESE PROPERTIES AND USES INTERESTS YOU?

Please indicate special interests by placing a tick in appropriate squares.

- ☐ Moulds for producing polyester/glass structures such as car bodies and boat hulls.
- ☐ Durable surface finishes in colour for conventional plastics mouldings.
- ☐ All-purpose adhesives, and metal-to-metal bonding for the aircraft and other industries.
- ☐ Accurate, quickly-produced tools in engineering, foundry and sheet-metal industries.
- ☐ Chemical-resistant coatings and glass laminates for chemical-resistant plant.
- ☐ Excellent resistance to water, solvents and chemicals (particularly alkaline solutions).
- ☐ Surface coatings with high quality finish and good adhesion to a wide range of materials.
- ☐ Electrical 'potting' and casting applications.
- ☐ Excellent electrical properties and arc-resistance, low flammability, and low shrinkage.

To: Bakelite Limited, 12-18 Grosvenor Gardens, London S.W.1. Please send me a copy of the folder containing 'Advance Information on BAKELITE Epoxide Resins'.

NAME _____ COMPANY _____

ADDRESS _____

TYPE OF INDUSTRY _____ P.2.

'BAKELITE' is a trade mark of Bakelite Limited, registered in Great Britain and certain other countries.

BAKELITE LIMITED

REGD.

12-18 GROSVENOR GARDENS · LONDON SW1 · SLOane 0898

Bakelite Limited manufacture an extensive range of plastics materials and maintain a technical service unequalled in the industry. No matter what your plastics problems, this service is at your disposal. SLOane 0898 is the telephone number.

TGA 881

Plastics

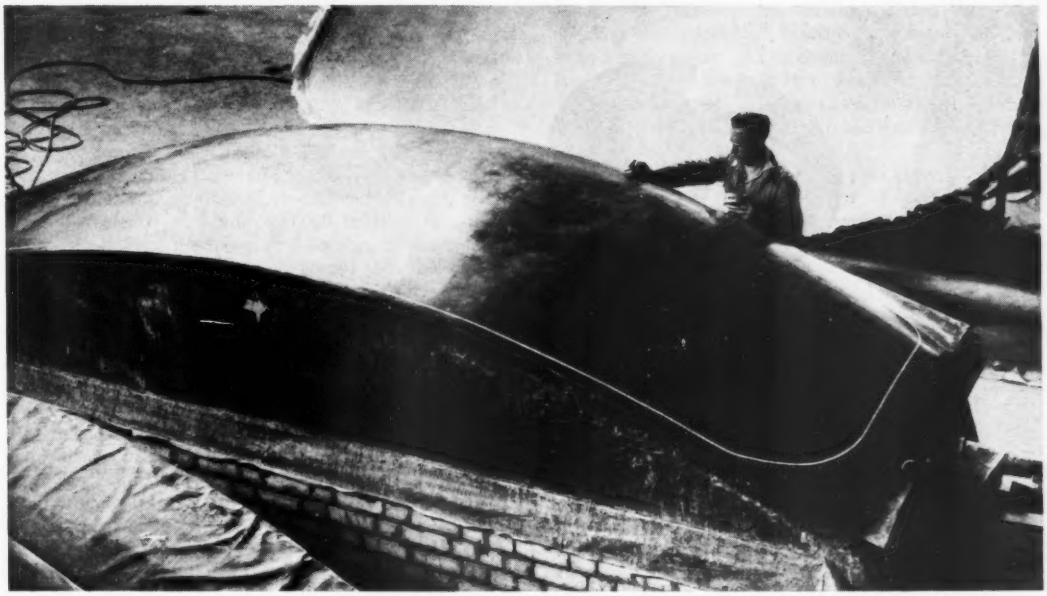
DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PROPRIETORS: TEMPLE PRESS LIMITED

CHAIRMAN and MANAGING DIRECTOR: ROLAND E. DANGERFIELD

CONTENTS

	Page
Editorials	351
Moulding Powder and Shot	352
Pre-Impregnation Materials for Reinforced Plastics	353
Resin-Glass Lifeboats for " Oriana " ...	357
Federation Conference	358
Continuous Production of Foamed Polystyrene	363
World's Industry Employs Plastics ...	364
Talking Shop	366
New Productions...	367
Plastic Film Converting Machine ...	370
The Troester Extr-a-Formatic Automatic Injection Moulding Machine	371
A New H.F. Pre-Heater	372
Plastics News	373
New German Instruments	377
Plastics Used in Solid Film Lubricants, by Thomas A. Dickinson	378
Book Reviews	380
Nottingham Conference on High Polymer Technology	381
The Electron Microscopy of High Polymers, by N. H. Langton and Margot Stephens	384
Patent Review	387



Compound curvature mould used in the production of Cossor Radar reflectors. The mould has been re-surfaced with Bakelite epoxide resin to replace the original stone plaster surface.

EDITOR: C. W. WELCH

ASSISTANT EDITOR: E. C. WHITFIELD

FOUNDER EDITOR AND CONSULTANT: M. D. CURWEN, B.Sc., F.R.I.C.

Published on the second Wednesday of each month by the Proprietors, Temple Press Limited.
Editorial, Advertisement and Publishing Offices: Bowling Green Lane, London, E.C.1. Telephone: TERminus 3636.
Annual subscription rate 44s. (Canada and U.S.A. $6.50).
Printed in England by Sir Joseph Causton & Sons, Ltd., London and Eastleigh.

WING NUTS?
HELP YOURSELF...
Help yourself and help the job as well, whatever it may be. When it comes to wing-nuts GKN make two types which between them fit most requirements. The best way to help you is to give you the choice . . .
GKN Cold-forged Wing Nuts (Nettlefolds Parker-Kalon) are a world standard. Designed for maximum strength, free from rough edges, they are available in steel and brass and with Whitworth, BSF, BA, UNC and UNF threads. Special finishes and special tappings can be supplied for quantities.
GKN Diecast Wing Nuts are light and rustproof. The material is zinc alloy. Smooth, accurate, corrosion-resistant, they are clean cut to close tolerances. The alloy takes any commercial finish. In Whitworth, BSF and BA, UNC and UNF threads or in special tappings for quantities.
IF IT'S A MATTER OF HOW TO FASTEN ONE THING TO ANOTHER...GET IN TOUCH WITH GKN

GUEST KEEN & NETTLEFOLDS (MIDLANDS) LTD. Screw Division, Box 24, Heath Street, Birmingham, 18
S/WI/2208

Plastics

VOL. XXIII No. 253 OCTOBER, 1958

EDITORIALS

Education in Plastics

AS we go to press with this issue, enrolments for courses in plastics technology at the various centres throughout the country are almost complete. Reports coming in throw a sombre light on the response by industry to the sandwich course and the part-time day release courses. Some of the colleges may well be forced to cancel courses in these categories unless there is a last minute improvement in the enrolment situation.

This news coincides with the publication by the Ministry of Education of a booklet entitled " Britain's Future and Technical Education." Its object is to describe how the technical colleges are being developed and to enlist the help of employers in carrying out this policy. The £100,000,000 programme for the expansion and improvement of the technical colleges, commenced by the Government in 1956 is now bearing fruit and although much still remains to be done, this country now has training facilities in the technical field at all levels far surpassing anything that was available 10 years ago. The crux of the problem, however, still remains to be solved. These ambitious plans are useless unless industry and commerce give the necessary backing.

The next few years will offer to industry and commerce an exceptional opportunity to recruit and train the larger numbers of technologists, technicians and craftsmen this country so urgently needs. It is freely acknowledged that our output of technically trained personnel has fallen lamentably behind that of America and Russia. Our chance to make good this deficiency, in part at least, comes both from the "bulge" in the birth rate which will increase the number of 15-year-old boys and girls in England and Wales from about 600,000 in 1957 to some 830,000 in 1962, and from the increasing number of secondary school pupils who have tended to stay at school after the age of 15 in recent years. The potential material for technical education will therefore increase in volume and will have a better basic educational background than has been the case hitherto.

The part of the technical training programme that relies so heavily upon support from industry is the sandwich course and the part-time day release course. In the former, students work six months in industry and six months at the technical college in rotation, generally over a four-year period.

The volume of comment in recent months from distinguished men in science and industry on the short-fall in industrial co-operation in these courses has been steadily increasing, Sir Willis Jackson, President of the Educational Section of the British Association said recently that the major weakness in British education, potentially ruinous, was the woeful neglect by many firms of the technical training of young people. Mr. Robert Carr in a recent letter to *Technology* said " We shall only increase the skill and quality of our industrial training if hosts of firms who do little or no systematic training at the moment can be stimulated into changing their ways."

These comments are, of course generalized; certain of our industries are particularly far-sighted and others woefully limited in their approach to this problem. The plastics industry, regrettably, falls into the second category. Whilst our major raw material manufacturers compete vigorously for the best that our universities produce, technical training, as distinct from the academic, on which the future of our broad manufacturing programme depends, is sadly overlooked by the majority of the fabricating companies. Only a small number have taken any positive steps in the matter.

The Government and the technical colleges have come more than halfway towards meeting all industries, including ours, in dealing with this national problem. The colleges will find it hard to produce the trained men that our industry needs, and will need even more in the future as our technology becomes more complex, unless companies within the industry are prepared to play their part.

Federation Conference

CONFERENCES may take many forms and the distance between the frankly recreational gathering and the serious concentration of intellect is as great as the income tax inspector will permit. Perhaps all shades of conference have their uses, for contrary to popularly held beliefs, directors frequently work hard, and if they choose to organize a " business " conference at some well-appointed spa or seaside resort in order to relax, who shall blame them ?

The conference of the British Plastics Federation at Torquay 12 days ago, however, was clearly a serious one. The choice of speakers was admirable, each in their respective fields acknowledged authorities. An account of the conference proceedings is published elsewhere in this issue.

Perhaps the most important contribution, on grounds of pure topicality, was that of Mr. Archie Renfrew, Overseas Director of the Plastics Division of I.C.I. In recent months the Free Trade Area has been the subject of exhaustive discussion, evidenced by the Plastics Institute's London Section meeting on the subject earlier in the year which was attended by well over 200 members of the Institute. Both the concept and the implications of the Free Trade Area are complex and difficult to define. Mr. Renfrew, speaking with special knowledge, has compiled by far the best summing-up of the situation as it affects the plastics industry to date. His comments will be read with keen interest and his conclusion, that the Free Trade Area will be beneficial to our industry, will crystallize latent opinion throughout the industry on this subject. Already, many British companies have formulated plans to deal with the changed circumstances if the Free Trade Area comes about. Those which have not will be well advised to study Mr. Renfrew's views as a basic text on which to build their own specific policies.

The contribution by Mr. R. MacDonald Watson pin-pointed another question concerning which there are many differing views, namely the advisability of a national campaign to stimulate awareness of plastics materials and mouldings, similar to the campaigns for leather and wood. He suggested that the Federation should initiate and execute the campaign, and put forward well-reasoned and convincing arguments in favour of a corporate publicity scheme which would represent the viewpoint of the industry as a whole.

Few would disagree with this as a general thesis; the feasibility of the project, however, is much more speculative. A nation-wide programme, directed to all levels of consumers, and embracing all the usual media, press and television, would involve very heavy expenditure, to the tune of thousands of pounds. The Federation has only 300 members, upon whom would fall the responsibility for raising the money, and it seems unlikely that all the companies involved would even consider such a major financial commitment.

MOULDING POWDER AND SHOT

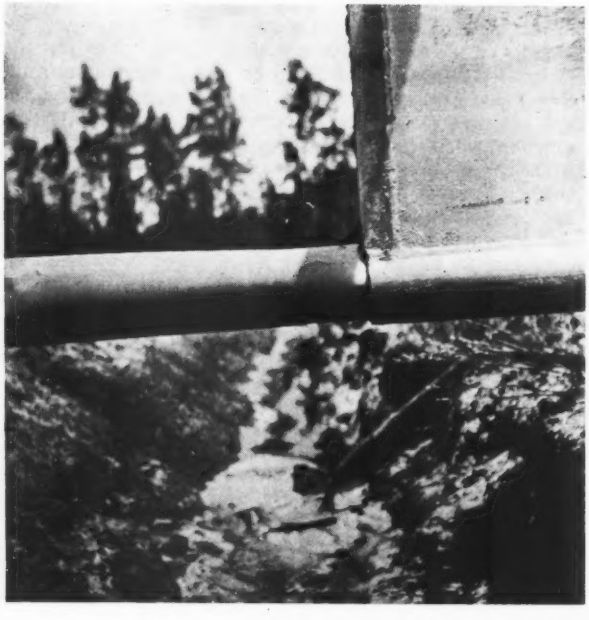
One of the most widely reported news items in recent weeks has been the statement by Lady Lewisham on the subject of plastic aprons. My ubiquitous information service notes references in the *Newcastle Journal*, the *East Anglian Daily Times*, the *News Chronicle*, and the *Eastern Daily Press*, which last-mentioned journal was so fascinated that it apparently mentioned it on two separate occasions in the same issue. Lady Lewisham, opening the Domestic Equipment Trade Fair at Olympia, said " Nothing is more degrading, more humiliating. more completely contrary to one's whole conception of a man than to see him in a plastic apron." With which general proposition I hasten to agree, begging only to question the relevance to the argument of the word " plastic." There is nothing, surely, particularly vile about a high-molecular weight apron *per se*. All aprons, plastic, cotton or even tulle, smack of servitude, and the very mention of being tied to the strings of one enrages even the meekest of men. Only the leather apron of the smith, or the rubber one of the surgeon, manages to circumvent these odious scullionary (*sic*) associations. Personally, I wouldn't be seen dead in an apron—a dish cloth stuck in the top of my trousers is good enough for me.

Votes for Men

* * *

A few years ago a farming friend of mine wanted to know if p.v.c. or polythene tubing could be used for land drainage. His idea was that instead of digging a trench and laying short lengths of clay pipes so that water could fall between the pipes and yet drain away through them, a mole plough should be used, laying the continuous plastics pipe at the required depth. The snag was that a continuous pipe would not let water in unless it could be perforated with holes or slots, and such a post-extrusion treatment turned out, on investigation, to be far too costly. Now I have news of an American development that solves the problem; it may well revolutionize land drainage for the cost of installation is stated to be one third of the old method. The Caterpillar Tractor Co., of Illinois, have made use of specially perforated p.v.c. sheet; mounted behind the tractor, a spool of the sheet is fed through shapers and direction changers in the " plough," resulting in a tube three inches in diameter embedded in the ground at the desired depth. The round shape of the pipe can be maintained by several methods, although soil pressure may be sufficient. Although Caterpillar are not yet ready to market the device, the technique is undergoing refinement by several U.S. agricultural colleges. The market for p.v.c. sheet is potentially enormous; in America, the U.S. Department of Agriculture estimates that 1½ million miles of sub-surface agricultural draining are required. In 1956, alone, 19,000 miles of agricultural drains were laid, costing 15 million dollars. The Bakelite Corporation of America has worked closely with Caterpillar on this project, which offers the first radical step forward in sub-surface drainage in over a hundred years.

Plastics for Drains



* * *

Forty years ago, Harold Wilson joined the Telegraph Construction and Maintenance Co., Ltd., following three years at London University where he obtained his degree in chemistry; last month he was appointed managing director of Telcon. The intervening years have been fascinating, years of interests ranging over wide fields. He specialized, first in rubber, then in plastics, and in aspect of his work, has brought to bear an enthusiasm and an ability of an outstanding order. He was chairman, first of the London Section Committee of the Plastics Institute in 1949–50, and then chairman of Council in 1953–55. He has seen the growth of Telcon's interests in plastics, was fortunate to be closely concerned with the first use of polythene for cables. He works, for Telcon, a great and indeed an historic unit of British Industry, for education, for the Institute, for his old school, City of London, and for any other cause which needs a powerful shoulder to the wheel. Last month I was privileged to attend a presentation, on behalf of the Telcon Education Committee, by Harold to Dr. E. W. Smith, whom he succeeds as managing director. It was a great occasion, for both men have made unique contributions to the cause of education within the Telcon group. To Dr. Smith, and to Harold Wilson, my warmest wishes, to the one for a fruitful retirement and to the other for all success in the even wider horizons that lie before him.

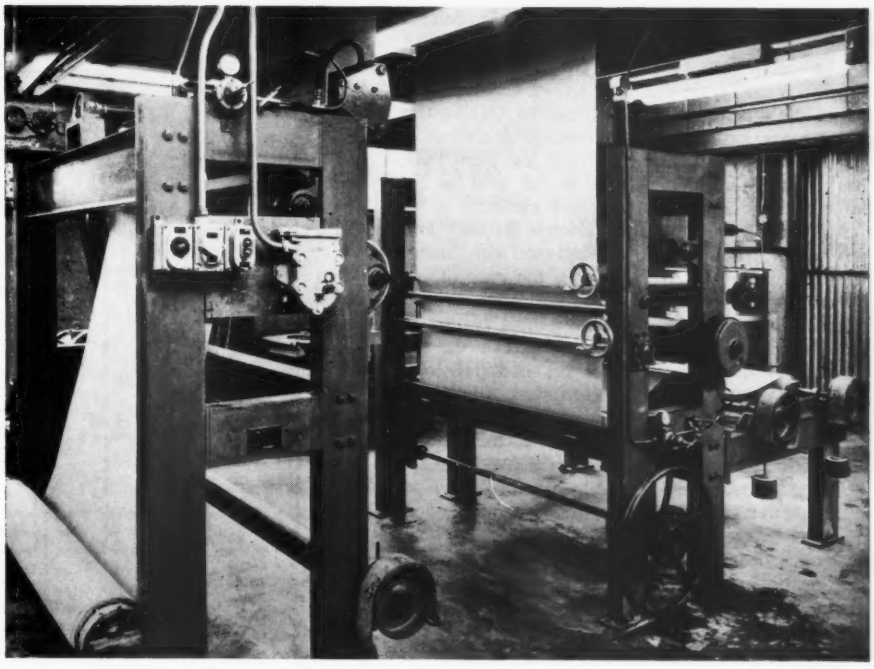
Harold Wilson of Telcon

* * *

This month the Reinforced Plastics Technical Conference of the British Plastics Federation takes place at Brighton; experts from all over the world will gather to hear news of progress in the resin-glass field and there will be much to discuss. Pre-impregnated materials, I suggest, will be one of the key topics, and there will also be much talk on the spray technique for wet lay-up. Participants in the conference will also want to make some assessment of the progress this branch of technology is achieving. News from the United States shows that production of polyester resins for reinforced plastics increased 14% in the first half of this year; last year's production was 43,000 tons. It is unwise to draw too definitive conclusions from these figures except to point out that only polyester and polythene resins have shown increased figures for the first six months of this year; all others are down on 1957, vinyls by 12%, phenolics 14%, according to figures supplied by the U.S. Tariff Commission. Fabricators in the U.S. have resolved some of the difficulties, it would seem, of the resin-glass process, and a figure of 43,000 tons cannot be regarded as anything but promising, and perhaps the Brighton Conference will show us how we may achieve a proportional figure in the U.K.

Resin-Glass Markets

DOGSBODDY



Side view of the Aeroplastics pre-impregnation plant, showing the unwind reels on the right and the wind-up gear on the left. In the centre is the resin tank, and the paper is seen passing between the two scraper bars into the first oven, where solvent is removed.

Pre-Impregnation Materials for Reinforced Plastics

IN attempting to evaluate the strategic importance of pre-impregnated materials, it is necessary to review briefly the situation in reinforced plastics to date. The emergence of the resin-glass industry in the U.S.A. during the 1939–45 war was due to the availability of a range of resins which could be chemically cured at room temperatures, permitting the production of large objects by semi-skilled and unskilled personnel for strategic purposes such as drop tanks, radomes, and assault craft. Following the war, this technique has been in a state of continual development, the majority of the work continuing on the principle that cure at ambient temperatures is the most desirable feature.

It is now generally recognized, however, that with this technique, very far from unskilled labour being suitable, a high degree of training and efficiency is essential if products of consistently high standard are to be maintained; with this thesis, few who have had experience in the resin-glass field would disagree.

The advantages of the hand lay-up process are nevertheless appreciated; first, low cost tools, of wood, plaster-of-Paris, light metals, etc., can be usefully employed, of special value when large structures such as boat hulls are to be manufactured. Curing is carried out at room temperatures, calling for no expensive heating plant. Complex shapes, specially designed for an individual component, are easily obtained.

The major disadvantages of the process are slow production cycles due to extended cure periods, and lack of uniformity in the finished product. The first is inherent in the process since room temperature curing cycles can never be very fast. The second is capable of resolution only by the exercise of great care, since the operation is essentially a hand one, resin being dispersed through the reinforcing agent by means of brushes or rollers. Consequently it is difficult to avoid variations in thickness and in resin distribution, and it is also difficult to avoid the introduction of voids due to air bubbles. It is also possible to damage the reinforcing fibres during the roller impregnating process unless care is used.

Because of the variables that are largely inherent in the wet lay-up process it has been difficult for resin-glass materials to take their rightful place in the engineering and structural fields by offering consistent physical, mechanical, electrical and chemical properties; where this desirable objective has been achieved, it has been effected mainly by closely controlled manufacturing programmes which have led to production costs, in many cases, only permissible in the manufacture of critical components for the aircraft industry and the like.

Pre-Impregnation

It has been realized for some time that if reinforcing materials could be pre-impregnated in some way with binder resins and other necessary components, the majority, if not all, of these variables could be eliminated. Pre-impregnation techniques have been extensively studied in America and the position today is that hand lay-up methods in the U.S.A. now constitute a secondary method of production. The hand lay-up process will remain as an important production technique in certain fields, particularly where short run productions are required. The translation of reinforced plastics into the mass-production field however, seems clearly dependent on the pre-impregnation method.

New British Plant

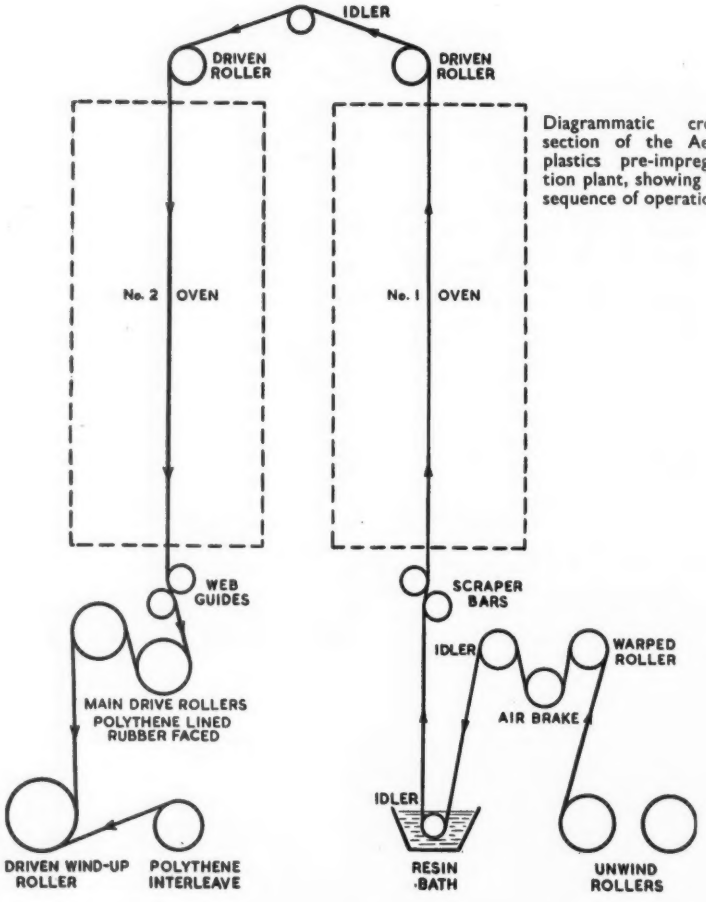
A plant for the manufacture of pre-impregnated materials has just been opened in this country by Aeroplastics Ltd., in Glasgow, under a licensing agreement with U.S. Polymeric Chemicals Inc. The information which follows is based on the Glasgow plant which is one of two operating this licence in Europe, the other, being located at Utrecht, Holland. The range of materials offered for sale by Aeroplastics is very wide. All types of polyesters, epoxides, phenolics, and melamine resins, are being handled, and in a short while the company will also be able to pre-impregnate

with silicones and silicone rubbers. Reinforcements being handled include glass mats, woven rovings and cloths, with all types of chemical treatment, together with Terylene, Orlon, nylon, asbestos; and paper reinforcements. Whilst therefore Aeroplastics are in a position to make an immediate and effective contribution to the resin-glass field, the plant itself has much wider implications in the field of reinforced plastics and laminates as a whole.

Materials are received at Glasgow in bulk and mixing is carried out in stainless-steel equipment, with explosion-proof motors. In the case of the polyesters, styrene-free resins are used, diallyl phthalate being used as the cross-linking agent. A fully equipped laboratory is maintained on the site to carry out quality control on materials and products and equipment includes apparatus, laboratory presses and other equipment. This laboratory works closely with the chemistry and engineering departments of the Fairey Aviation Co., Ltd., the parent company of Aeroplastics Ltd.

The plant is basically a standard impregnating unit designed by the Frank Egan Co. of America, built under licence in Britain by Bone Bros., Ltd. Certain modifications by U.S. Polymeric Chemicals Inc. are incorporated in the design.

As will be seen in the flow diagram (Right) the unit is of the vertical type, a breakaway from conventional horizontal impregnating equipment. The material to be impregnated is fed off the unwind roller into the resin bath and upwards, between scraper bars through the first oven. This oven is designed to remove solvent and the impregnated reinforcement then passes over the top of the machine and down through the second oven which is designed to advance the resin to the requisite stage of cure. The reinforcement is then wound up on the rewind rolls. Provision is made for interleaving polythene film if necessary at the wind-up end.



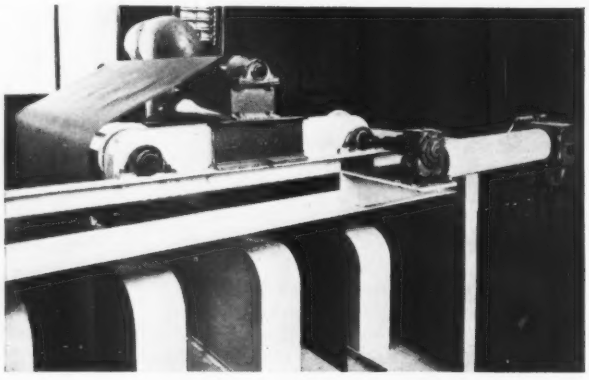
Diagrammatic cross-section of the Aeroplastics pre-impregnation plant, showing the sequence of operations.

The drive for the complete unit is a Reliance variable speed drive unit, operating through an electronic computor which controls all phases of the drive automatically. The operator needs only to manipulate one control unit which works the final speed of the web.

The steam temperature and control equipment is designed by Honeywell Brown Ltd., and all controls are pressurized to prevent ingress of solvent vapour. The rollers on this machine permit the impregnation of materials up to 54 in. wide.

Chemical Control

In addition to the obvious ingredients of a pre-impregnating solution, certain trace chemicals are employed. For example, with a polyester resin, the resin bath contains a typical solvent, peroxide catalyst, cross-linking agent and other items. The trace chemicals are present to determine rate of cure, flow, gel, and shelf life. They ensure that the pre-impregnated material, which requires no further chemical treatment when it leaves Glasgow, will store without degradation for the specified period of time and will only commence to cure under the correct moulding conditions.



View from the top of the plant, showing the two driven rollers and the idler.

Whilst the design and engineering of this vertical plant constitute a major step forward in this specialized field, the greatest contribution has come from the introduction of the trace chemicals and from acquisition of the necessary knowledge required to confer such a wide range of moulding characteristics on the end products. Control of the process is obviously critical in view of the large number of variables which are interdependent upon each other and which effect all of the properties of the finished product. These variables include the state of glass or other reinforcing agents and knowledge of the chemical treatment the glass has undergone, the state of the resin, the amount of cross-linking materials present in the case of polyesters, the quantity and types of trace chemicals employed, the solid contents of the impregnating bath, the web speed, the rate and quantity of resin pick-up, the temperatures of the solvent removal and curing ovens and the angle at which the reinforcing material enters the resin bath. All the foregoing factors are critical and will determine the properties of the pre-impregnated material at the rewind end, the performance of the material during moulding, and the performance and properties of the end product.

Whilst close control of all of these factors is vital, therefore, the process permits a flexibility of product which is most advantageous. Taking polyester-glass pre-impregnates as an

POLYESTER/GLASS PRE-IMPREGNATION—CHARACTERISTIC PROPERTIES
(All properties given below either indicate the available range or typical values. Variables can be closely controlled to suit individual requirements)

	Reinforcement	
	Chopped strand glass mat (2 oz. per square ft.)	Woven glass roving (21 oz. per square yd.)
Properties of Pre-impregnation:		
Resin content	48–78%	42–46%
Gel time	45–65 secs.	45–65 secs.
Drape	Fair	Good
Tack	Fair	Good
Storage life	6 months	6 months
Mechanical Properties of Laminate:		
Specific gravity	1.5–1.8	1.7
Ultimate tensile strength p.s.i.	15,000–24,000	34,000
Tensile modulus p.s.i. ...	$10–19 \times 10^6$	2.0×10^6
Compressive strength p.s.i.	30,000–50,000	28,000
Flexural strength p.s.i. ...	20,000–35,000	40,000
Impact strength (Izod) ft. lb. per inch notch	11–25	20
Barcol hardness	55	55
	The grade used would depend on the pressures to be used during moulding. A rough guide would be:— Less than 50 p.s.i., resin content 70–78%, 50–200 p.s.i., resin content 58–65%, over 200 p.s.i., resin content 48–55%.	As this material has a lower bulk factor than pre-impregnated polyester glass mat it can be used to make dense laminates at a lower resin content. This grade is intended for low pressure moulding. This material drapes easily if required for making preforms.
Moulding Conditions:		
Pressure	From 10 p.s.i. to 200 p.s.i. may be used with proper choice of specification.	From 10 p.s.i. to 100 p.s.i.
Moulding Temperature: ...	The recommended cure temperature is 250° F. ± 10°.	250° F. ± 10°
Cure Time:	The cure time is dependent on the thickness of the laminate and temperature. A Barcol hardness of 55–60 usually indicates complete cure. For example a ⅛ in. thick laminate requires 5 mins. at 250° F. and 100 p.s.i. Post cure is not necessary in the case of triallylcyanurate polyester laminates required for high temperature service.	The cure time is dependent on the thickness of the laminate and temperature. For example a ⅛ in. thick laminate requires 5 mins. at 100 p.s.i.

example, it is possible to produce a dry non-tacky sheet which will be ideal for certain applications, and also to produce a highly tacky very flexible pre-impregnate which will be suitable for other applications where outstanding drape properties are necessary. When tacky materials are being produced a polythene film interlayer is introduced at the rewind end of the process to facilitate handling.

The end properties of the pre-impregnate are easily controlled therefore, and they include resin content, gel time, flow, drape and volatiles. The table shown here, giving typical specifications for polyester-glass pre-impregnations, indicates the range of properties which can be achieved within this flexible process.

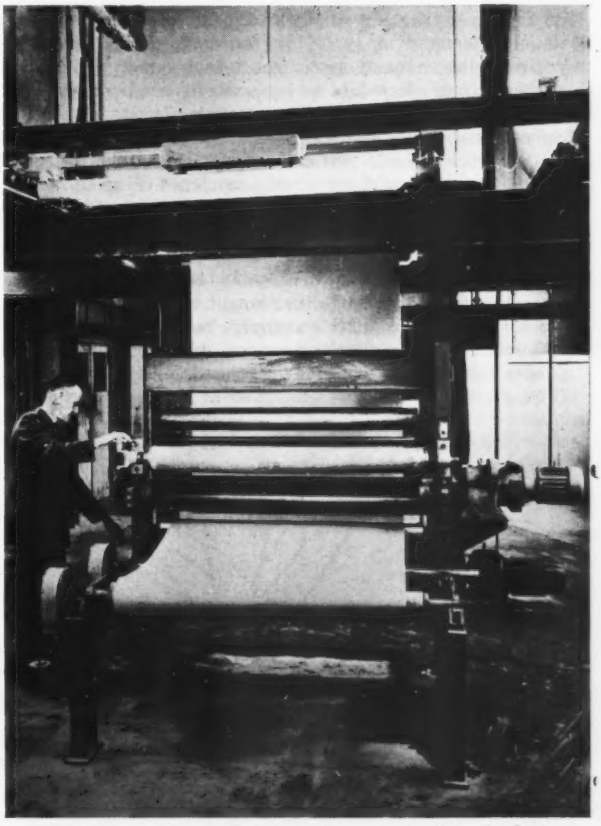
Advantages in Fabricating

In terms of fabricating, the use of pre-impregnated materials offers many substantial advantages. Eliminated immediately is the time-consuming and therefore costly process of hand-impregnating the reinforcement with the resin. In addition, precise control of the finished product is possible in terms of its physical characteristics. This stems from the known characteristics of the pre-impregnateon arrival at the factory and the even distribution of the resin throughout the reinforcement. The even distribution of resin, the absence of air voids and the uniformity of the materials permit predictable and high quality products. These advantages which appear both in reduced handling costs and superior properties are calculated to off-set the higher price of the pre-impregnated materials and the necessity for heat and pressure in their fabrication.

These pre-impregnated materials can be cured at temperatures in the region of 250° F., and at pressures of 10 lb. per square inch to yield economic moulding cycles. Even lower temperatures, in the order of 160° F., can be employed provided that the operator is prepared to accept longer moulding cycles. Whilst, therefore, some heat is necessary to trigger-off the curing action, to counteract the effect of the inhibiting trace chemicals, it is possible to fabricate these materials at pressures and temperatures which are well within the range of many of the small as well as the large fabricators.

Obviously, applications for the polyester-glass pre-impregnates will include all of the small dimension mouldings where reasonable production runs are envisaged. Within this category might fall typewriter cases, automobile dashboards, and the like. For large products, such as boat hulls, the difficulty of employing heat and pressure may inhibit the large scale application of the materials until long run productions permit the employment of large moulding-area presses, for example of the rubber bag type.

For silicone pre-impregnates, applications include slot stators and slot liners for electrical components. Silicone rubber impregnates will be used for high temperature flexibility applications; typical applications include flexible hot air ducting for jet engine starting motors, pressure sensitive high temperature sealing tapes, and industrial diaphragms. Materials of this type have flexibility characteristics over the temperature range —65 to +550° F. Applications for the epoxide pre-impregnates



End-on view of the plant, showing the unwind roller. At the top of the photograph is the base of the first oven.

Aeroplastics tool room in the No. 1 Glasgow factory.

Main moulding shop for compression work.

include printed circuit base materials, tubing for the oil industry, etc.

Paper Impregnates

The paper impregnates are distributed by R. H. Cole Ltd., and have special spheres of application. Aeroplastics hold some 300 English, Italian, and German patterns, and offer through R. H. Cole a completely comprehensive range of coated papers, overlays and underlays. These can be used on pulp boards, hard boards, and other synthetic building products for use on standard plywood presses.

Pulp boards can be moulded direct into decorative shapes and all of the paper pre-impregnates are suitable for low pressure moulding techniques.

These developments by Aeroplastics offer an extension to the range of work carried out by this company which was formed in 1935 and which became a wholly owned subsidiary of the Fairey Aviation Company in 1940. In the compression moulding department the company specializes in high quality mouldings for engineering, electrical, and electronic components, and employs all compression moulding materials. The press capacity includes some 40 presses of capacities ranging from 12 to 750 tons, including side ram and transfer machines. Injection capacity, at the moment comprising machines of up to 40 oz. capacity, will shortly be enhanced by the availability of machines with 60 and 120 oz. capacities. The company also carries out the fabrication of acrylic sheet and has an extensive resin glass department specializing in aircraft work.

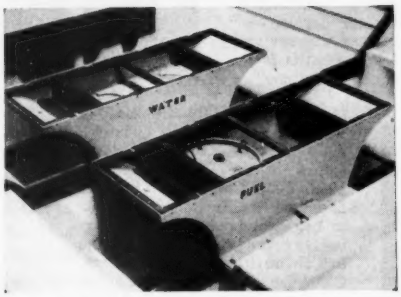
The plant is self-contained with a large tool room and drawing office and the Glasgow factories comprise over 90,000 square feet of floor space. Aeroplastics are also able to call upon the extensive technical resources in the chemical and engineering fields of the parent company. By pioneering, in Great Britain, the manufacture of pre-impregnated materials, Aeroplastics have significantly widened their contribution to the plastics industry, and may well have played a major part in the consolidation of the reinforced plastics technique.

Ship's ventilator in polyester-glass materials being tested in the Fairey Aviation Co.'s wind tunnel.

We are indebted to the management of the Company for the facilities made available in the preparation of this report.

No. 1 factory of Aeroplastics Ltd., on the Hillington Industrial Estate, Glasgow.

Resin-Glass Lifeboats for "Oriana"



Two of the island seats with tops removed, showing fuel and water tanks.

THE laying of the keel of the "Oriana" for the Orient Steam Navigation Company in September, 1957, at the Barrow-in-Furness Yard of Vickers Armstrongs (Shipbuilders) Ltd., was the most convincing reply yet by British shipowners to the increasing competition from air travel and changing conditions generally. Her 40,000 tons will make her the largest British liner to be built since the "Queens."

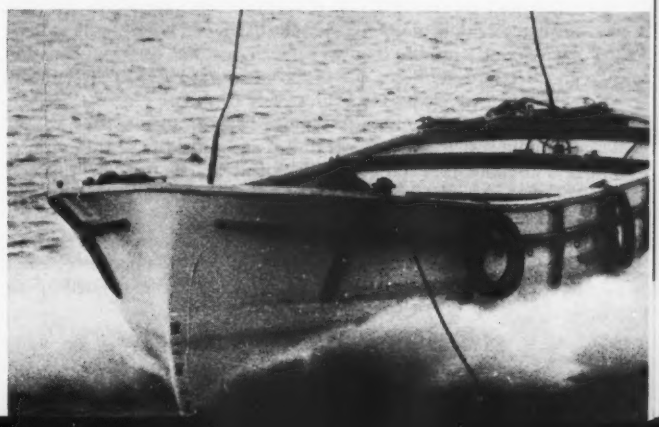
The Orient are spending some £12,500,000—50% more than the cost of their entire pre-war fleet—in providing lavish accommodation for the 600 first class, 1,500 tourist, and 900 crew to be carried. Providing lifesaving equipment for 3,000 persons is in itself no small task, and the Orient have spared no pains in ensuring that the lifeboats to be fitted are of the highest quality in every respect.

To this end they commissioned the Weymouth boatbuilding firm of W. & J. Tod Ltd.—one of the pioneers of glass fibre boats—to design and build a 36 ft. 9 in. × 12 ft. beam × 5 ft. deep amidships glass fibre lifeboat, embodying the attractive lines and very high finish for which this company is noted with the exceptional robustness so necessary in a lifeboat, which would be light in weight and require the barest minimum of maintenance.

The prototype was completed early in 1957, and so keen were the owners to try her out in service that their liner "Oronsay" was diverted into Weymouth Bay to collect it from the builders. Since that date it has been put into the water on every possible occasion in the Mediterranean, Atlantic, Pacific and Indian Oceans, cramming in more use than would be expected in a complete lifetime under service conditions.

These trials have proved so satisfactory that the Orient had no hesitation in ordering 20 such boats for the "Oriana," making her the first liner to be completely equipped with glass fibre lifeboats when she enters into service in 1960, and forming perhaps the most valuable order ever placed for such craft, running into a total cost of six figures.

The hulls of these lifeboats are moulded in one piece, having no joints or fastenings to open up, and the numerous bulkheads and seven deep longitudinal members—all in glass fibre—are moulded integrally with the hull, resulting in deep box girder sections and a homogenous structure of great strength. Some idea of the problems entailed in moulding these craft may be gauged from the fact that when lifted from the mould the hull and internal framing weighs some 2½ tons, and throughout the process strict control must be maintained over resin cure to avoid any section being fully cured before the final section is moulded in, covering a period of some three weeks. To obtain the greatest possible strength the ratio of Fibreglass Ltd.'s 2 in. chopped strand H.P.E. glass mat to the resin, supplied by B.I.P. Chemicals Ltd., was kept to the highest possible figure. The two level side seats, incorporating built in buoyancy, island seats, having portable tops to form stowage lockers, engine casing, air ducting, provisions, water, and fuel tanks, these last-mentioned translucent so that the contents can be seen, are all moulded in the same material, colouring being pigmented in as and where required, reducing exposed woodwork to such minor items as gunwale cappings, and in consequence almost eliminating the problems of maintenance.

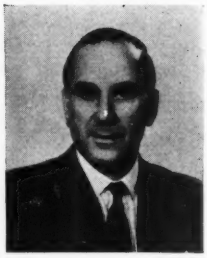


(Above) Under way, fully loaded. (Right) The drop test, demonstrating the integral strength of these resin-glass lifeboats.

Federation Conference

TORQUAY, SATURDAY, SEPTEMBER 27.

FIVE distinguished members of the plastics industry addressed the 1958 Conference of the British Plastics Federation here this week. In the following pages, the papers of two of the speakers are reproduced in full, the contributions of Mr. Archie Renfrew and Mr. David Radford. The papers of Dr. H. M. Stanley, Mr. H. A. Collinson and Mr. R. MacDonald Watson will appear in the next issue of *Plastics*. Biographical information on the speakers, and the titles of their papers are given below.



H. M. STANLEY. Controller of Research and Development, Distillers Co., Ltd. Graduated from Birmingham University in 1925, appointed research assistant in Department of Petroleum Technology, Birmingham, 1927–30, awarded Ph.D. in 1930. Joined Distillers Co., Ltd., in same year, has specialized in petroleum chemicals and their derivatives.
"Raw Material Requirements of the The British Plastics Industry, Today and Tomorrow."

A. RENFREW. Overseas Director, I.C.I. Plastics Division. Joined I.C.I. as research chemist in Nobel Division in 1928. Entered the plastics field via nitrocellulose, and worked on methyl methacrylate and polyvinyl chloride. In 1941 became first technical salesman in the Plastics Division at Welwyn Garden City.
"The Impact of the European Free Trade Area on the British Plastics Industry."

H. A. COLLINSON. Educated at Winteringham School, Grimsby. A.R.I.C. 1944. F.R.I.C. 1948. Fellow of the Plastics Institute 1958. Chief Chemist to Leicester Lovell 1940. Technical Director to Leicester Lovell 1946. Managing Director 1956. Member of the British Institute of Management. Chairman of the main technical committee of the Plastics Federation and member of Council.
"The Technical Future of the Plastics Industry."

D. RADFORD. Educated at Nottingham University College. Joined Morris Organization, served as Technical Liaison Officer. Associated with work on the Bailey Bridge, joined E. K. Cole Ltd. as Works Manager in 1943, became general manager of plastics division, 1951, and was appointed Director and General Manager of Ekco Plastics Ltd., in 1957. Vice-chairman, Plastics Federation.
"The Commercial Future of the Plastics Industry."

R. MACDONALD WATSON. Publicity and Sales Promotion Manager, B.X. Plastics Ltd. After graduating from Edinburgh University, joined printing industry. Served with the Royal Navy during the war, afterwards returned to publishing in Scotland. Member of the publicity committee of the British Plastics Federation. Joined B.X. Plastics Ltd. in 1949.
"The Publicity Requirements of the British Plastics Industry."

The Impact of the European Free Trade Area on the British Plastics Industry

By A. RENFREW

THE countries likely to be involved in the European Free Trade Area are the six present members of the European Common Market—West Germany, France, Italy, Belgium, Luxembourg and the Netherlands—and the remaining 11 members of the Organization for European Economic Co-operation—the U.K., Austria, Switzerland, Norway, Sweden, Denmark, Greece, Turkey, Portugal, Iceland and Ireland. The first six members of the second group—U.K., Austria, Switzerland, Norway, Sweden and Denmark—are generally known as "The Other Six," and have discussed together the possibility of an association which might develop into something closer if a Free Trade Area were not formed.

As a means of promoting freer trade between the O.E.E.C. countries, it is proposed to remove progressively, as now arranged within the C.M., certain barriers. Whereas at present each country applies its own rates of customs duties against the products of the others, the proposal is that by 1970 these tariffs will have been reduced progressively to zero.

It is also the intention to remove between members of F.T.A. all quota restrictions, export duties and subsidies. Furthermore, it is intended that trade shall be fair as well as free. To this end rules may be introduced on transport rates, export aids and monopolies.

Measures may also be introduced to "harmonize" wages, to free the movement of labour and capital, and to finance common development programmes. These aims are also expressed in the constitution of C.M., where they are likely to prove more forceful than in F.T.A.

At present we speak of the U.K. market as the "home market" and the remainder of the world as the "export" market. The F.T.A., with a population of 243 millions, will become the "home market" while the remainder of the world will become the "export" market. The home market will grow from about 300,000 tons to about 1,340,000 tons of plastics a year.

The Plastics Import-Export Position

The F.T.A. market for plastics is served primarily by the four large manufacturing countries, namely West Germany, United Kingdom, France and Italy in that order. Of these four only France consumes more than she herself produces, while the others are net exporters. All the remaining countries in F.T.A. are net importers of plastics.

The F.T.A. as a whole exports to the rest of the world about 80,000 tons. Imports from the rest of the world amounted to 90,000 tons in 1957, nearly double the 1955 figure. These imports were almost entirely from the dollar area and half of 1957 imports were polythene from the United States.

The Common Market

Enough has been said above to give a picture of the position of the U.K. in the projected F.T.A. and to give some preliminary idea of its importance. It is, I think, essential to look for a moment at the origins of the C.M., at the historical precedents for such a revolutionary idea and at the C.M. organization and institutions. The origins of the C.M. were economic but the driving force has been political. Politics and economics, of course, react upon one another and the effect of trade on political considerations is becoming more important every day as indicated by the title of the C.M.—The

European Economic Community. The father of the C.M. and the Chairman of the Committee, which drew up the first draft of what became the Rome Treaty signed in March, 1957, was M. Spaak, of Belgium, and the Group of six countries has, somewhat irreverently, been referred to as " Spaakistan." An early supporter of the scheme was Dr. Adenauer, of Germany, and he frequently became impatient at those who introduced economic objections. The C.M. was, indeed, thought of as another step towards the formation of a United States of Europe: the first one was the formation of the Coal and Steel Community in 1952, a body with which the U.K. is now associated and which has worked smoothly in times of consumer demand. One of the objectives of both the Coal and Steel Community and of the C.M. is the avoidance of a third world war in Europe. Time and space are both shrinking so rapidly that the last two world wars now look like civil wars. One strong argument for U.K. participation in the economic affairs of Europe in times of peace is indeed the inevitability of her participation in times of war.

Great Britain stood aloof from the Common Market discussions although she did send an observer to early meetings. Her main objections were the inclusion of agriculture, the existence of Commonwealth preference (which she thought incompatible with the C.M. arrangements) and most important of all, the institution of supranational authorities. Most people now think that none of these objections were really important and that Great Britain made a mistake in standing aloof from the C.M. discussions and therefore giving up all hope of altering the C.M. terms from the inside before the signing of the Treaty.

The most interesting historical precedent for the C.M. and one which points out most clearly one of the dangers of such an arrangement, is the formation of the Zollverein. This customs union was formed in 1834 between 18 States with about 24,000,000 inhabitants and was dominated by Prussia. It led to the unification of Germany and, indirectly, to the World Wars. Some depressing analogies have been drawn between the position of the Austrian Empire on the fringe of the Zollverein and the British Empire on the fringe of the Common Market. The important lesson to be learnt from the Zollverein is that the economically powerful partner dominates the rest. Germany will certainly dominate the Common Market if an F.T.A. is not formed.

At one time the U.S.A. looked with great favour on the Common Market although many clauses in the Treaty ran counter to those in the General Agreement on Tariff and Trade and, indeed, to the American economic policy since the War. There are now signs that American industrialists are becoming alarmed at the possibility of a really effective C.M. and some opposition can be expected.

The various Institutions set up in the Treaty of Rome have not yet begun to function. There are close links between them and those of Euratom and the Coal and Steel Community.

Free Trade Area

The suggestion to form an F.T.A. was put forward by Great Britain at a meeting of the Council of Ministers of the Organization for European Economic Co-operation in July, 1956: the expression was, however, first used by France in the discussions at Havana which led to the G.A.T.T. Since August, 1957, Mr. Maudling, as Chairman of the appropriate O.E.E.C. Committee, has spent much of his time on F.T.A. affairs. One of the many differences between the F.T.A. and the C.M. is that the C.M. countries will ultimately present a uniform tariff barrier to the rest of the world, whereas each of the F.T.A. countries may have its own tariff barrier against the rest of the world. This has been the source of many difficulties in the discussions, difficulties concerning such complicated topics as certificates of origin and " harmonization " of tariffs.

France is actively against the formation of an F.T.A. although, in the last meetings of the Ministers of the six C.M. countries, she made considerable concessions. France is, of course, a highly protectionist country and was induced to join the Common Market only after Germany had made repeated concessions. Indeed, it has been said that when the words " balanced " or " harmonious " appear in the Rome Treaty, it means that the French were " worried about one of their industries and wanted to protect it." Italy is luke-warm in its welcome to the F.T.A., but Belgium, Holland, Luxembourg and Germany are in favour of it, particularly Germany which is most anxious to extend its sphere of influence.

The present position of the F.T.A. negotiations is unsatisfactory. A meeting of the six Ministers of the C.M. countries was held in Venice on September 18 and September 19 in an attempt to formulate a C.M. policy about the F.T.A. In October, Mr. Maudling's O.E.E.C. Committee will meet for a long session and it is hoped that many of the outstanding problems will be solved. In official circles there is still a good deal of optimism that some kind of F.T.A. may be formed if not instituted by January 1, 1959, and there is still talk that the F.T.A. countries might on the same date reduce their tariffs to the same extent as the Common Market countries.

The U.K. Position in the Free Trade Area

All this talk about the C.M. and F.T.A. has been quite general. Let us now look at our particular interests as producers and fabricators of plastics in the U.K. and let us see what our position would be in the F.T.A.

Since 1950, the consumption of plastics in F.T.A. has quadrupled and is growing at a rate of about 18% per year. The average *per capita* usage is just over 12lb./head. The following table illustrates how consumption in the F.T.A. market was split in 1957.

PLASTICS CONSUMPTION IN F.T.A., 1957

	'000 metric tons	lb./capita	% of total
Western Germany	460	19.7	34.3
United Kingdom	307	13.1	22.9
France	200	10.0	14.9
Italy	129	5.8	9.6
Netherlands	59	11.8	4.5
Sweden	56	16.9	4.2
Belgium/Luxembourg ...	33	8.0	2.5
Switzerland	28	12.2	2.1
Austria	28	8.9	2.0
Denmark	24	11.8	1.8
Norway	15	9.5	1.2
	1,339		

51,000 tons valued at £11m. were exported to the F.T.A. by the U.K. Apart from home demand, therefore, the total extent of the U.K.'s stake in the market for plastics in F.T.A. was equivalent to 4% of the total market of 1,340,000 metric tons.

F.T.A. COUNTRIES, U.K. AND WESTERN GERMANY TOTAL EXPORTS OF PLASTICS

	F.T.A.	U.K. (metric tons)	Western Germany (metric tons)	U.K. %	Western Germany %
1950	60,931	44,011	5,000 est.	72.2	8.0
1953	141,549	66,585	39,000	47.0	27.0
1954	208,918	81,230	61,000	39.0	29.0
1955	270,143	94,956	87,100	35.0	32.0
1956	322,109	109,343	110,000	34.0	34.0
1957	383,448	124,683	145,300	32.5	38.0

Western Germany has trebled her exports to the F.T.A. since 1953 but the U.K. figure has not yet been doubled, as will be seen from the table above.

Although U.K. exports over 30% of its total sales at the present time, its position as an exporter against that of the F.T.A. as a whole is declining slightly. The figure fell to 33% in 1957,

and, for the first time, West Germany exported a larger share than we did.

As an importer, the position of the U.K. is that more than half its purchases are now from F.T.A. countries, whereas seven or eight years ago nearly 70% came from the dollar area. The trend towards purchasing from F.T.A. sources rather than dollar countries is increasing.

Tariffs are at present a serious obstacle to trade. Their removal is bound to promote it in both directions, but the extent to which trade grows, once barriers have been removed, will depend mainly on the growth of total European consumption. Therefore, the largest gains in trade will generally be found in the consumer durables industries and in the newer industries such as petroleum chemicals—of which the plastics industry constitutes an important sector. The *Economist* publication, " Britain and Europe," has estimated that, by 1970, exports of chemicals from U.K. to the F.T.A. countries could expand from £49m. in 1955 to £125m. Since plastics account for about 17% of chemical exports to the F.T.A., then clearly if this share is maintained, the U.K. plastics industry ought to be geared to meet an export demand from F.T.A. of at least £27m.—more than double the value of 1957 exports. In tonnage terms, this means that this country must be capable of exporting about 100,000 tons/year of plastics to the F.T.A. area in 1970. A considerable amount of capital investment will therefore be required to deal with this demand. British industry, on the whole, is confident that F.T.A. will bring increased trade, thereby enhancing the prosperity of all but a few branches of manufacturing activity. Optimism should, however, be tempered with caution in view of the large capital investments being made by chemical industry in Europe, particularly in the field of plastics.

The effect of uniformity of institutions, habits and mental attitudes on trade is very great and as Europe becomes more uniform and moves towards a common currency and perhaps even a common language, the internal business in plastics will grow rapidly. Some useful lessons can be learnt from trade developments between Canada and the U.S.A.

The plastics industry is closely related to the petrochemical industry and, for many years, the plastics industries of the U.S.A. and the U.K. have been based on chemicals derived from petroleum. Europe lagged in having no mature petrochemicals industry. Today this country is still well ahead with such plants as I.C.I. at Wilton and Billingham, British Hydrocarbon at Grangemouth, Shell at Partington and Stanlow and Esso at Fawley: in Italy there are new ventures for synthetic rubber, vinyl chloride, ethylene, propylene, etc.: in France there are many new chemical and plastics enterprises based on petroleum cracking; and in Germany the four big chemical companies have invested either in hydrocarbon cracking by novel methods or in conventional oil cracking operations carried out in conjunction with established oil refining companies; and in Austria, which is the largest oil producing country in Europe, the nucleus of a petrochemical-based plastics industry has now been established.

While the U.K. is unlikely to lose its lead in such developments in F.T.A., the amount of capital being invested in Europe in petrochemicals is substantial. Furthermore, there are signs that American companies are establishing manufacturing facilities in Europe in order to overcome the disadvantage of being outside the F.T.A. (and the C.M.).

One of the big advantages which Great Britain should possess, is cheap transport, and this is likely to become important inside the F.T.A. Great Britain has other big advantages—efficient management and enlightened labour. Both of these should pay dividends in the future.

A few figures not only reveal the pattern of export markets by the U.K. and Western Germany, but also show where gains and losses have occurred since 1953.

The trend of U.K. exports has been strongly away from the dollar area whereas Germany has increased her sales to those countries.

U.K. AND WESTERN GEMANY PLASTICS EXPORTS

	U.K.		WESTERN GERMANY	
	1953 Metric tons	1957 Metric tons	1953 Metric tons	1957 Metric tons
To O.E.E.C. countries roughly the F.T.A.	30,603	62,222	31,500	97,000
To the dollar area	7,980	5,480	1,800	12,500
To other countries	28,002	56,981	5,700	35,800
	66,585	124,683	39,000	145,300

The U.K. should be well able to continue to increase her stake in the F.T.A. export market but dollar area sales may continue to decline.

Finished products are not included in the figures quoted above. Indeed, there is only a small trade in fabricated plastics articles, but, of course, if there should be an F.T.A. and tariffs should ultimately disappear, an immense market for fabricated products would be open to British manufacturers. Conversely, of course, manufacturers in other F.T.A. countries would be able to export to Great Britain but the net result would almost certainly be beneficial to the British plastics industry. The present U.K. position as an exporter of fabricated plastics is shown on the following table:—

U.K.—EXPORTS OF PLASTICS RAW MATERIALS AND FABRICATED ARTICLES

	Raw Materials (£ millions)	*Fabricated* (£ millions)
1950	9.12	2.37
1951	16.32	2.66
1952	13.61	2.26
1953	16.55	2.79
1954	20.56	3.42
1955	22.81	3.42
1956	26.15	3.60
1957	29.91	3.90

Growth has been clearly negligible.

The U.K. Position if there is no Free Trade Area

If the negotiations for the formation of an F.T.A. should break down—and most observers think this unlikely—the " other six," the U.K., Austria, Switzerland, Norway, Sweden and Denmark—might get together with perhaps the Commonwealth. Such a powerful combination could exert a strong influence. So indeed, could other local groupings. The Nordic Council (Denmark, Norway, Sweden and possibly, Finland), for example, may well decide in November, 1958, to form a customs union even if the F.T.A. negotiations are not then complete.

If the F.T.A. is not formed British industry will suffer as a whole. In 1957, as we have seen, the U.K. exported 51,000 tons of plastics to the F.T.A. About 50% of this tonnage, 26,000 tons, went to the C.M. as shown in the following table:

Common Market	*U.K. Exports* (Metric tons)	*U.K. Imports* (Metric tons)
Western Germany ..	3,007	9,068
France	8,308	981
Italy	3,731	2,277
Netherlands	6,836	3,876
Belgium and Luxembourg	4,270	328
TOTAL	26,152	16,530

The loss of any substantial fraction of this tonnage would be serious and would be inevitable over the C.M. tariff wall, remembering that behind it there would be no tariffs between the " six." The C.M. would, of course, suffer too since they export

17,000 tons to the U.K. Ways of diminishing these exports would no doubt be found if an F.T.A. were not formed.

Much more serious to the U.K. than any loss of exports to the C.M. would be the strength of the C.M. as an exporter of plastics in other world markets since the C.M. would negotiate as a whole.

Manufacture in the C.M. would, of course, be possible but time is short and Great Britain, although technically equipped to manufacture plastics within the area has contented herself with licensing and financial participation.

If there should be no F.T.A., Great Britain would have to depend very largely on her research and development. If Great Britain were fortunate enough to produce a good new plastic, there is no doubt that she could sell it over almost any tariff barrier. An intensification on research and development is desirable, of course, whether or not there is an F.T.A. but, without one, it is absolutely vital to our future prosperity.

My thanks in compiling this brief note are due to my colleagues Dr. T. Ward and Mr. W. J. Sutton.

The Commercial Future of the Plastics Industry

By D. RADFORD

INSOFAR as the title of my paper is concerned, I could say in a very few words what the future is, since the only reason I am here today is because I believe the future is very bright indeed.

However, one might well ask why I am thus optimistic. If one reviews the turnover in plastics materials over recent years, the figures, and the relative export figures, read as follows:—

Year	*Production*	*Exports*
	Tons	*Tons*
1950	155,000	35,156
1951	195,000	53,124
1952	180,000	48,472
1953	210,000	59,517
1954	273,000	73,299
1955	316,000	84,823
1956	338,000	97,968

These figures tell their own story, and I cannot help thinking that in line with the American industry these production figures will go up at an even steeper rate during the coming years.

What has caused this phenomenal growth of the industry ? Until the outbreak of World War II the big usage, of course, was in thermosetting resins, and the products from these resins, and there is no doubt that the majority of the articles which were moulded in those days were of such a nature that the public knew or cared very little about them, and it is only since the thermoplastics came into the field that the public has generally become better acquainted with plastics as a whole.

Poor Quality Products

In my opinion, the biggest disaster that ever happened to the industry was the introduction, in the early post-war years, of articles made of plastics material, which were entirely unsuitable. Unfortunately, in certain fields it is possible for unscrupulous persons to purchase a mould and a press and produce something in large quantities which is neither useful nor ornamental and is no credit to the industry, but on the other hand still increases the doubt in the public's mind as to the wisdom of using plastics at all.

It seems to me, however, that in this year of grace the industry is now firmly established, and everyone is beginning to regard plastics as essential to the modern way of life, although it must be readily admitted that amongst the white population of the earth the use of plastics *per capita* of the population is probably lower in England than elsewhere. This being the case, there is still plenty of leeway for bigger and better production.

At one time most of the companies engaged in producing end products relied entirely on the manufacturers of raw materials to control specifications, test materials and generally look after the more technical side of our business, but today I really believe that most responsible firms have their own development and laboratory sections and are greatly concerned with the maintenance of high quality, apart from anything that the raw material suppliers may do. This, in my opinion, is probably one of the biggest steps forward that the industry has seen, and I wish we could encourage it more and more. I believe it has largely been brought about by the intensive efforts of the Technical Committees of the British Plastics Federation, whose work is greatly valued by those of us who understand what it is all about.

I am not here today to extol the virtues of the Plastics Federation, but it is very sad when people give as a reason for not joining the Federation that they seem to get nothing out of it. If they only knew what troubles they might have found themselves in had it not been for the activities of the Federation and its Technical Committees they would join tomorrow, and many Companies in this country are relieved of manufacturing problems and liabilities even although they are not members of the Federation.

How we shall develop commercially is rather difficult to forecast and it seems to me quite obvious, both here and in America, that the usage of thermosetting materials has steadied down to a level which I do not think can reasonably be expected to increase. Many of the thermoplastic materials are being used where formerly thermosetting was the rule, and are doing a better job, but thermosets will remain but, I think, only at the present level of production.

Therefore, any expansion, I feel, must come on the thermoplastics side of our industry.

Insofar as the end product is concerned, this is tied up in the injection field, extrusion, vacuum forming, blowing and fabrication. I would not be rash enough to forecast which of these will produce for us the biggest turnovers, but from the knowledge which I have and the business circles in which I move, I think that injection moulding must come out on top.

There may, of course, appear on the market new materials but I was at the laboratories of one of our leading raw material manufacturers recently, and the Director in Charge shook his head sadly and said he regretted that so far as he knew there was nothing in the test tube at the moment. But new materials will come, as this is an inevitable process of the activities of the research chemist, who never knows what may lie ahead.

Export Business

We must, of course, for our anticipated expanding activities look to the export field for some of our business. If you examine the figures which I quoted earlier, you will find that the percentage of our exports has increased in the same proportion as our production, but still not enough. The difficulties of export are well enough known to me since I have been particularly associated with them in the last two years. Tariff barriers are probably our principal difficulty although we are faced, of course, with ever increasing rates of pay in this country, and these have increased in the post-war years at a greater rate than those of our overseas competitors always, of course, excluding America.

We must not overlook the fact that we are on the threshold of new trading arrangements on the Continent of Europe, and I am personally surprised to note that there are many people in this country who view the common market with some apprehension. The Commonwealth countries are trying desperately hard to produce at home all the things they previously bought from Great Britain, and it seems to me that Europe is the market we must really pursue with all the vigour at our disposal.

We shall probably all have to revise our ideas: the things now made in this country may be produced cheaper abroad and vice-versa and if we only continue by way of research, design, tool construction, plant and machinery to maintain quality above all else irrespective of price, we are bound to come out on top.

The efforts of most of us in the export field have, I feel, been

rather puny. We still live in a world of 50 years ago, making what we think the foreigner requires without bothering to go and see for ourselves what he really does need and making it for him. We continuously send abroad representatives who have to rely on English as their only language.

Turning a little further East from Europe we must not, of course, forget Russia and China. Both must be huge potentials for the products of our industry. Since the visit of our own colleagues to Russia some two years ago I am reliably told that the Russians have purchased a quantity of machinery in this country and certain raw material, but they must be a huge potential for consumer goods in addition, and slowly but surely the Russian will demand a common standard of living with his Western neighbours, and the same will apply in China. Since I understand that by 1960 every fifth person in the world will be Chinese, this is hardly a market we can afford to ignore.

Now that we have such a wide field of activity, from laminated board to simple injection moulding, we are able to cover every phase of industry and commercial activity, and when we are able to prove to designers that plastics are being used in their right sphere they will remain there and never be ousted by other materials.

My commercial experience in plastics is, of course, rather limited to the products of a moulders shop, and believing that our big future lies in injection moulding rather than compression moulding I can envisage a greatly increased number of large machines, say, 200 oz. and upwards.

Vacuum Forming

Whilst vacuum forming has filled a long felt want in many industries, it is not so successful in some spheres as had at first been thought to be the case. For instance, to take the interior liner of a refrigerator. True, it can be vacuum formed accurately and well: it can have its shelf runners moulded in at the same time, but after vacuum forming invariably one finds an enormous number of ancillary operations which have to be carried out—slots, holes and other apertures to be made, all of which require time and cost money. Now, however, that it is possible completely to injection mould a refrigerator liner, this can come from the machine in a finished condition ready to fit to the refrigerator itself, and whilst the tools may cost upwards of 10 times the cost of a vacuum forming tool, the resultant saving in speed and money, provided the quantities are large enough, make it an economic possibility.

The one great dearth, I feel, is the lack of competent technicians: men of skill and vision who can foresee production requirements, design tools more cheaply and more accurately and give us a better finished product. There is no doubt that moulding tools are too expensive and the capital cost of such tools in many cases frightens the prospective buyer and makes him look to more orthodox fields. The tragedy of it all is that when these very expensive tools have been made, particularly injection moulding tools, they seldom, if ever, wear out, because the production required from them is not large enough. If we could only open up our export markets in a satisfactory manner this situation would improve, and it would pay us more handsomely to lay down these expensive tools, knowing full well that the production from them would be adequate and justify them.

In the realm of household goods I must say that most housewives are now completely sold on their usefulness. The lack of noise, the lightness, and other features, particularly brightness of colours, have appealed tremendously, and the variety and range of products is a matter for ever increasing wonder.

I hope I have not been too optimistic but I think it is a good thing to have an optimistic outlook, and I am sure that if we all continue to strive as we are doing at the present time, we must remain successful or become even more so than we are today.

Torquay Social Programme

THE consistently high level of the papers presented at this conference was reflected in the numbers attending each session. For the ladies, a full programme had been arranged, including a sea trip to the River Dart Estuary and a tour of Dartmoor. The gentlemen of the Federation took their relaxation at the dances held each evening. On the second night, delegates were entertained by the Corporation of Torquay, and on the last night the President and Chairman of the Federation, and their ladies, Mr. and Mrs. H. V. Potter and Mr. and Mrs. Norman Punfield, held a formal reception, attended by the Mayor and Mayoress. Then followed a banquet and a ball, with a cabaret. The high light of the evening was the screening of a film, the last part of which had been shot the previous night. By miracles of tight scheduling, Mr. E. W. Jefferies had it developed and printed in London and flown back to Torquay. Mr. Jefferies has an obvious flair for filming, and produced a brilliant record of the conference which delighted the audience.

The organization of a conference of this size is a complex matter. Mr. Basil Aldis, supported by Mr. Trevor Wells and other members of the Federation staff, had worked extremely hard in planning each function, in arranging transport, accommodation and all the other details which must be right if the event is to be a success. His reward was the obvious pleasure of all the delegates; the job could not have been done better. All who attended this year's Conference will look back on a most enjoyable three days in good company at Torquay, coupled with a stimulating and wholly worthwhile lecture programme.

(Left) Mr. and Mrs. David Radford.

(Below) L. to R. Mr. E. Gaspar, Mrs. V. Lambert, Mr. and Mrs. A. Chambers, Mr. V. Lambert, Mrs. and Mr. W. Norman.

The Deputy Mayor and Mayoress of Torquay receive Mr. and Mrs. J. Crossley.

Continuous Production of Foamed Polystyrene

THE first plant to be commissioned outside the U.S.A. for the production of expanded polystyrene by a continuous moulding process came on stream at the works of Styrene Products Ltd., Partington, near Manchester, last month. This announcement marks a further advance in the technique of producing a plastic material which finds many applications as a heat and cold insulant and for other purposes.

The raw material, i.e. the polystyrene bead, is manufactured by a new and improved process developed by Styrene Products Ltd. (an associate of Shell Chemicals Co., Ltd.). Besides using the bead in their own continuous moulding process Styrene Products are able to offer it as a raw material to other moulders or users.

When used in their own plant the beads are pre-expanded by passing them continuously through a live steam cabinet. By controlling the time within the cabinet the degree of pre-expansion can be set. The pre-forming operation is a necessary step in the manufacturing of foamed polystyrene either as a moulding or in log form. It enables a mould to be filled before final expansion takes place and thus eliminates voids and unevenness in the final product; it gives faster cycle times in the final fusing process; it also ensures even density throughout the final product.

From the pre-expanding operation the beads are air-conveyed to storage hoppers where they are matured and stored until required for moulding.

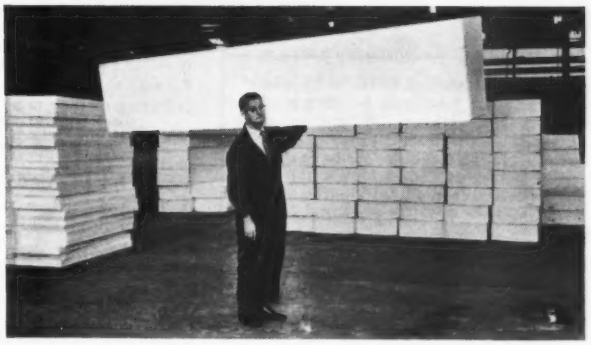
There is very little information available on the continuous moulding equipment used by Styrene Products Ltd. It was originally developed by W. M. B. International A.B. of Sweden, from whom Styrene Products have the exclusive operating rights in the U.K. and Commonwealth excluding Canada. The machine produces a continuous log up to about 10 in. thick by 24 in. wide at the rate of up to 5 cu. ft. per minute (a linear speed of 3 ft. per minute). The daily capacity of the plant is reported as being over 4,000 cu. ft. This method of manufacture is said to have several advantages besides the more obvious one of volume of production. Strict control of fusion ensures maximum efficiency in thermal insulating properties throughout the log. Uniform control of density is another of the more important advantages quoted.

As mentioned previously the foamed polystyrene emerges as a continuous log. This is then cut at suitable intervals, depending on the length required and the log stored for drying. When the log is sliced to give boards of ½ in., ¾ in. and 1 in. and multiples of 1 in. up to 10 in. Alternatively it can be supplied in blocks.

Typical properties of expanded polystyrene are given in the accompanying tables.

Typical Properties of Expanded Polystyrene:

Density	1 lb./cu. ft.
Water vapour transmission (temperate conditions, all faces cut)	<2.0 grains/hr./sq.ft./in. Hg.
Maximum advisable temperature for continuous use	70° C.
Co-efficient of linear thermal expansion	7.4×10^{-5}/° C.
Spontaneous ignition temperature	>680° C. (1,260° F.)
Heat distortion temperature	77° C. at 5 p.s.i.
Water absorption % by volume (all faces cut)	2.5% after 7 days total immersion at 20° C.
Power factor at 1 Mc/s	0.0001
Permittivity at 1 Mc/s	0.04



The log emerges from the moulding machine in a continuous length.

Thermal Conductivity (K) in B.Th.U.'s/in./sq. ft./hr./° F.

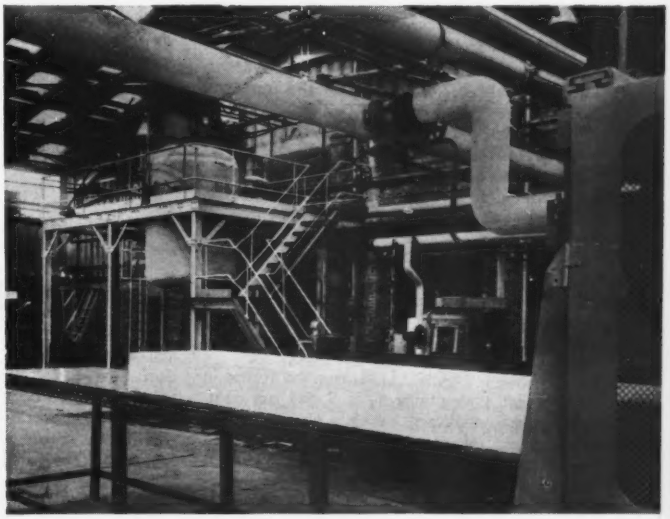
Density	Mean Test Temp. ° F.	B.Th.U.
1 lb./cu. ft.	+ 50	0.25
1¾ lb./cu. ft.	− 22	0.19
1¾ lb./cu. ft.	− 125.5	0.14

Expanded polystyrene is a multi-cellular structure in which the cells are non-communicating and contain air. This gives the boards exceptional thermal insulation properties. In addition the boards are resistant to the passage of water vapour, are rot-proof and immune to deterioration. Cutting or shaping can be done by the usual woodworking saws and in addition hot wire cutting can be used where complex curves or shapes are required. Both methods are used for the production of pipe insulating pieces.

Styrocell, which is the trade name for the product manufactured by Styrene Products Ltd., is available in two grades; a self-extinguishing grade and a standard grade, the latter having a nominal density of 1 lb. per cu. ft. A higher density is available if required (1¾ lb. per cu. ft.).

Application

Expanded polystyrene is already widely used in the frigeration industry as an insulating material in cold storage rooms, deep freeze rooms, cold lockers, road and rail containers and the like. It also has a large potential outlet in the building trade where it is finding increasing application as an economical insulating material, and as anti-condensation membranes in walls, floors and ceilings. It is also used in sandwich construction as a core between facings of many different types of constructional material. Applications outside the insulation field include buoyancy, decorative and packaging.



World's Industry Employs Plastics

A monthly survey of technical articles published in journals throughout the world.

The original articles from which these abstracts are taken can be seen at the Patent Office Library, 25 Southampton Buildings, Chancery Lane, London, W.C.2. Photostat copies can be obtained from the same source, price 1/6 per page (postage extra). It should be noted that the page number given below the abstract is that of the page on which the article commences.

MATERIALS

Rilsan Fibres

A PAPER read before the 29th Congress of Industrial Chemistry, November, 1956, by L. Notarbartolo of S.N.I.A., Viscosa. After a brief account of the preparation of 11-amino-undecanoic acid and its properties, the author examines different methods of polycondensation to obtain the polyamides. He describes an industrial process for the production of Rilsan polyamides by means of an apparatus which allows the polymer to be handled in the fused state and to be drawn continuously into fibrous form. He reviews the differences which exist between this process and conventional processes for polycondensation of the polyamides " 66 and 6."

(*Industrie des Plastiques Moderne*, 1958/February/44.)

Polish Synthetic Fibre Industry

DRZEWINSKI, Czekaluk and Kozlowski outline proposed plan for the development of the synthetic fibre industry in Poland. Comparative tabular data of production in various countries, including Poland, is given for the years 1950 to 1957, and in Table 4 more detailed data on production schemes are presented for various resin groups in Poland to the year 1970: the table gives some Polish trade names.

(*Przemysl Chemiczny*, 1958/June/395.)

Polyurethane Lacquer

AN account is given of the properties and uses of a two-component, polyurethane lacquer, " Stabilo-Glas-H," developed in Austria. Components are mixed just prior to application and can be held for use up to six hours. Coating sets in 1 to 2 hours and is fully hard in 8 to 10 hours. It may be applied to a perfectly dry surface by brush or spray. It is described as being as chemically resistant as chlorinated rubber and not affected by acids, alkalies, petroleum, organic solvents or alcohol. It has high hardness and mechanical strength.

(*Bau und Holz*, 1956/Nov.–Dec./162.)

Characteristics and Uses of the Polyamides

HELMUT PECKHAUS lists the forms in which polyamides A, B, S, SH, are commercially available, their physical and mechanical properties, and inorganic and organic chemicals to which they are resistant or by which they are attacked. Among the applications noted are gear wheels and bearings. The author concludes by considering the sawing, turning, drilling, milling, filing and polishing of the polyamides.

(*Der Plastverarbeiter*, 1958/May/172.)

" Epoxy " or " Epoxide " Resins?

DISCUSSION is devoted to the precise significance attaching to each of these terminologies as visualized by Paquin on the one hand and by Korfhage (and Lissner) on the other. Some issues of psychological and commercial importance might be considered as depending on the clarification of the argument.

(*Kunststoff-Rundschau*, 1958/July/293; 294.)

TECHNOLOGY

Compounding Polyurethanes

A STUDY has been made of the compounding of polyurethane foams to yield the combination of useful physical properties and improved resistance to humid-ageing exposure.

(*Ind. Eng. Chem.*, 1958/July/1041.)

Continuous Oxygen-Initiated Ethylene Polymerization

A LABORATORY study of the oxygen-initiated polymerization of ethylene in a continuous system was undertaken to obtain data which could be more readily interpreted than those from batch systems heretofore reported in the literature.

Correlation of the new experimental data led to the development of equations describing the course of the reaction. Product evaluation tests showed the effects of synthesis conditions on the properties of the polymer.

The results of this investigation can serve as a guide to those interested in making a variety of grades of polythene by the high pressure route.

(*Ind. Eng. Chem.*, 1958/July/1049.)

Effect of Temperature on Impregnation of Reinforcement in Polyesters

AN examination of the effect of temperature on the wetting and impregnation of reinforcement such as glass fibre in polyester resins. In particular the behaviour of a number of " Rhodesters " is considered. It is shown that by conducting polymerization at raised temperatures, impregnation is not favoured as a result of decrease in viscosity of the resin. Experiments covered the cases of a resin without catalyst and moulding under a press. It is noted that the relationship between gelling time and viscosity is more interesting than the viscosity of the resin alone, as the penetration of the resin into the reinforcement during moulding is inversely proportional to the viscosity and directly proportional to the time during which the resin is able to flow, that is to the period of gelling. The relationship between temperature and gelling time is elucidated. From the data presented it is concluded that if a resin catalyzed with benzoyl peroxide be heated, the time of gelling diminishes much more rapidly than the viscosity. In industrial moulding it is usual, first of all, to place the reinforcement in the mould, then to pour the resin into the mould at a given point, counting on the pressure exercised when the mould is closed to distribute the resin entirely over the reinforcement. It may happen that the reinforcement is incompletely impregnated and, for such a case, instead of raising the temperature of the mould, it will then be necessary to lower it. The account is accompanied by some mathematics and by data in tabular form.

(*Industries des Plastiques Moderne*, 1958/February/41.)

Creep and Stress-Rupture Behaviour of Polyethylene Resins

TO evaluate plastics for long-time load-bearing applications, a simple creep and stress-rupture apparatus has been developed. The data obtained are useful in product development of structural or semistructural application.

Degree of crystallinity has a great effect on creep behaviour. For any given density (crystallinity) the probability of rupture or fracture is considerably greater for resins of high melt index. Largely amorphous resins fail because of excessive creep or deformation, resins of higher crystallinity (density) fail by rupture with little elongation.

The high strength with highly crystalline resins, indicated by short-time tests, has not been borne out by long-time tests. Detailed data make it possible to estimate the life expectancy and manner of failure of a spectrum of resins.

(*Ind. Eng. Chem.*, 1958/July/1045.)

Chemistry of the Epoxy Resins

IN the third and fourth sections of an exhaustive examination of the detailed chemistry of the epoxy resins, Paquin refers in the course of the text to silicon—containing epoxy resins, and to others containing sulphur. Combinations of the epoxy resins with those of other groups is examined. Bibliography of 389 references, mostly to the patent literature.

(*Kunststoff-Rundschau*, 1958/June/234; July/287.)

Polyalcohols and Polyfunctional Esterification

A REVIEW covering the period from the present-day back to 1932. Brief summaries are given of the appropriate chemistry of the more commercially important polyalcohols, with special emphasis on the practical differences between the products which may be obtained from them and the present and potential future applications of these in the plastics and lacquer industries. A useful bibliography of 105 references is given.

(*Kunststoff - Rundschau*, 1958/July/283; August/337.)

Equivalent Values for Effectiveness of Different Plasticizers for P.V.C.

DR. STAECKHART points out that quantitive measurements on the effects of various plasticizers for p.v.c by current methods do not permit the direct determination of the equivalent values of the various media. It

would be desirable if these could be established on the basis of a factor derived from the value for D.O.P. = 100, materials with higher plasticizing effects being assigned numerical values lower than this, and those with smaller plasticizing influence being given greater numerical values, this being a logical system for use where equivalent values of plasticizing are to be obtained when the plasticizing media for particular mixes are to be substituted by others. Some comments are made upon the commonly used American system of "Efficiency Concentration" and a list of American manufacturers' publications is presented to show the diverse methods employed to determine this value. A lengthy table follows in which basic values for a range of plasticizers are given as determined by the different methods, an average value being then derived for each plasticizer. It is indicated that the factors obtained are not necessarily valid for the comparison of half-hard and very soft mixes obtained with any one plasticizer. The factor for an n-ester is 3 to 4 units lower than that for homologous I-esters of the same acid. For a given alkyl group, the factors for adipates and phosphates are about 10 units lower than for phthalates. In the case of sebacates, the factor lies about 3 units lower than for phthalates with the same alkyl group. It is desirable that manufacturers of plasticizers should give values for these factors on specifications of their products. The best means for deriving the factor would seem to be by determining the quantity of various plasticizers necessary to give, with a film, an extension of 100% for a stress of 100 kg./cm.^{2}.

(*Kunststoffe*, 1958/March/103.)

Variations on the Central Runner in Simple Injection Mouldings

KARL MÖRWALD discusses the importance of runner dimension and form in relationship to injection nozzle size and form. He then considers various types of runner and their effect on the successful operation of the press and on the quality of the resulting moulding. Working diagrams illustrate a variety of forms of runner, the use, advantages and limitations of which are commented upon in the text.

(*Der Plastverarbeiter*, 1958/May/169.)

MACHINERY

Extraction, Distillation, Rectification, Mixing, Dissolving, Dispersing, Centrifuging, Drying, Comminuting

A SERIES of short accounts describing latest types of industrial plant and equipment for these processes, and listing names of manufacturers in Germany. Illustrated with line drawings to show modes of operation, etc.

(*Chemische Industrie*, 1958/July/series commences on p. 349.)

Effect of Input Variation in Injection Moulding of Thermoplastics

WALTER MINK distinguishes between the feeding conditions desirable for continuous (as for example, extrusion) and discontinuous production, particularly with respect to volume, and with respect to the effect on this latter factor of particle shape and size. The use of self-acting feed mechanisms delivering predetermined weights of moulding powder is discussed and much of the apparatus is illustrated and described in detail. Volumetric feed devices are also examined (with diagrams and illustrations) at length.

(*Der Plastverabeiter*, 1958/May/162.)

APPLICATIONS

Russian Plastics Industry

SUMMARY detailing the current plan to accelerate the development of plastics and plastic-intermediate production in the U.S.S.R. The all-round widespread interest of Russian industry in plastics is emphasized. It is stated, for example, that the TU-104 aircraft has 100,000 parts partly or wholly of plastic. Great interest centres on the possibility of replacing heat-resisting metals by plastics. In the production of plastics, the Soviet chemical and petroleum industries will play the same part as the mining and metallurgical industries in the manufacture of metal goods.

(*Kunststoff-Rundschau*, 1958/June/251. See also *Kunststoffe*, 1958/August/353.)

Plastic Floor Covering

AN account illustrated in colour dealing largely with the practical and decorative values of p.v.c. floor covering. Special reference is made to "Pegulam"—brand p.v.c. for this purpose, manufactured by Pfälzische Plastic Werke G.m.b.H., Frankenthal. In the same journal appears an article on "Elastileum" p.v.c. floor covering manufactured by Heinrich Nolland Co., Selters, Westerwald, Germany. This is a built-up material designed to facilitate laying, overcoming difficulties at doors, and simplifying the problem of bedding down on uneven floors.

(*Tapeten Zeitung*, 1958/April 20/16; 18.)

Plastic Tubes for Floor Heating

A BRIEF note on the possible uses of plastic tubes for the elements of steam heating equipment for floors. Developments are still in the early experimental stage but reference is made to tubes of "Klétylène" (Kléber-Colombos), and "Plasmet-Rilsan" (C.F.M.), which are said to be able to withstand the effects of very hot water under pressure.

(*Batir*, 1958/May/22.)

Prefabricated Fittings for Natural Lighting

A NOTE refers to the following manufacturers of prefabricated lanterns and domes in plastic for natural lighting: "Voltaplex," sold by "Lisoplex," 19 Rue de Dammarie, Melun, France. "Lanterplex," sold by "Vitra," 32 Rue de Turbigo, Paris 3e. -Ets. Reynaud, 16 Rue Colber, Grenoble.

(*Batir*, 1958/May/23.)

Plastic-Faced Panels

SHORT note on plastic-faced wall panels for kitchen and bathroom use sold under the brand name "Décomur" by Sté. Sofeco, 23 Rue Louis le Grand, Paris 11e. The panels consist of a veneer of "Cordoual" on a backing of "Isorel," and measures 127 cm. × 185 cm. or 127 cm. × 255 cm. The material is easily worked and set in place and is resistant to all the conditions encountered in kitchen or bathroom. It is available in 30 shades.

(*Batir*, 1958/May/23.)

Foamed Polystyrene in Building

COMMUNICATION from the Kunstoff-Rohstoff Labatorium der Badische Anilin und Soda Fabrik A.G. The properties and uses of "Styropor" are set out. It is available in sheets 100 cm. × 100 cm. and 1 cm. to 3 cm. thick, and in long coils 1 metre wide and 5 mm. to 15 mm. thick.

(*Hoch und Tiefbau*, 1958/April/32.)

Plastics in Dredging

A PAPER read by Taal at the Glass Textile Conference, Aix-les-Baines, September, 1957. Referring to dredging problems in Holland, the author shows how, as a result of increasing capacity, it has become necessary to lighten the weight of dredging units in order to avoid pontoons or boats of inconvenient size which would otherwise be required to carry them. It was for this reason that attempts were made to use plastic tubes and buckets. First attempts failed due to lack of knowledge on the part of the manufacturers as to the best methods of fabricating plastics for the purpose and because the mechanical requirements of plastics for service of this type were not known. An extensive research programme was undertaken to solve the problems involved in the adoption of plastics for certain working parts of the dredging apparatus. Glass-fibre reinforced polyesters were principally examined, the glass fibre being obtained from the Fibre de Verre S.A., Lausanne, this being woven into the requisite form by the de Bary concern at Basel. The theory of reinforcement for heavy duty components is studied in conjunction with research on the properties of the glass textile reinforcement; the method of calculating the tensile strength of laminates is examined and finally attention is given to the use of reinforced plastics for dredger buckets. Under each of these three headings the author presents, concisely, a wealth of detail, much of which is the result of entirely original research and is possibly applicable in many other fields. Valuable data are presented in the text whilst the illustrations included are highly informative. The author gives the following reasons why plastics are still not employed to any great extent in dredges: First there are insufficient manufacturers with enough solid experience in the production of nozzles, buckets and the like, whilst manufacturing plant itself is in any case imperfect. Secondly manufacturers otherwise willing to undertake the work are not convinced that it will be to their profit, and, finally, there is a lack of suitable technologists for manufacture of this type. Glass reinforced polyester tubes 60 mm. diameter, 6 metres long and of 2 mm. wall thickness, have been made and the author notes that a company has been founded to undertake work of this kind and began production at the end of 1957. If this application of wound glass laminates is successful it will become one of the biggest consumers of these materials. To suppliers of glass reinforcement the author suggests that they should market only such materials for any given service whose suitability for that service they have studied.

(*Industrie des Plastiques Moderne*, 1958/January/1.)

TALKING SHOP . . .

Pendley Manor.—In July this year some 27 teachers, examiners and others concerned in the dissemination of plastics technology converged on Pendley Manor near Tring to attend the first of what is hoped to be several conferences. Pendley Manor is a privately owned residential centre of adult education and under its Director, Dorian Williams, provides a wide variety of courses. On this particular weekend the facilities of Pendley Manor were shared between the "plasticians" and a glossary of short story writers.

During the weekend of the course papers were presented and discussions took place on a variety of subjects relevant to the teaching of plastics technology and it was generally felt on the Sunday evening that the weekend had been both enjoyable and informative. The course had been arranged by the Plastics Institute.

* * *

Plastics Exhibition—Olympia.—This month sees the ballot taking place for the allocation of space for the "1959 International Plastics Exhibition." As usual the exhibition is being organized by *British Plastics* and they report that over 270 firms from 11 different countries have applied for standspace. The exhibitors are being placed in one of three categories for the purposes of the ballot, according to the number of times they have been represented at previous exhibitions. Incidently the date of the Exhibition is June 17 to June 27, 1959.

* * *

High Temperature Resistant Laminates.—The search goes on for laminates to withstand high temperatures so that they can be used for missile nose cones. Readers will remember an article we published in March this year describing the work of H. I. Thompson, Fiber Glass Co. of Los Angeles, in which, by using a nearly pure silica fibre as reinforcing media and a special phenolic resin as binder, it has been possible to produce laminates to withstand practically 5,000° F. for comparatively long periods. Latest news in this field comes from America also where Taylor Fibre have manufactured a composite laminate from nylon and asbestos reinforced phenolic. Tests on a ¼ in. sheet showed that continuous exposure to 2,000° F. on the outside raised the temperature ⅛ in. below the surface to only 500° F. after five minutes and only 910° F. after 19 minutes. An important factor in this use of nylon is that the heat carbonizes it and tends to make the moulded material erosion resistant.

* * *

Reclaiming Scrap.—Apparently reclaiming scrap thermoplastic material is big business in America and it has been estimated that between 5% and 10% of the total sales of polythene, polystyrene and vinyls are reclaimed material. A new method of pelletizing scrap particularly the softer materials has been reported, in which the scrap is chilled to between 0° F. and 50° F. In this state it is fed into a centrifugal mill which, it is reported, gives a more even particle size. Besides this, however, considerably higher throughputs are possible, one machine is quoted as having an output of 2,000 lb. per hour and a second, now in the design stage, will handle 20,000 lb. per hour.

* * *

Fibreglass Superfine Insulation.—A new booklet issued by Fibreglass Ltd., presents some interesting and impressive data on their new Superfine insulation material designed for use in aircraft. There are two types manufactured, Type 1A, very fine glass fibres of mean diameter .0001 in. bonded into a flexible mat with a phenolic resin having a density of 0.6 lb. per cu. ft., and type 2A, very fine glass fibres of mean diameter .00006 in. also bonded into a mat by a phenolic resin. Type 2A has a density of 0.5 lb. per cu. ft. Both types can be supplied faced with a .005 in. p.v.c. film on one or both sides.

* * *

Alexander Kennaway.—Colleagues in the industry will be interested to hear that Mr. Kennaway has joined the Metal Box Co., Ltd., as Assistant on plastics to the Chief Technical Engineer. He is to form a new section to be responsible for the development of the technology required to fabricate plastics in the packaging field.

Mr. Kennaway was educated at St. Paul's School and Pembroke College, Cambridge. During the war he served with the Royal Navy,

Mr. A. Kennaway

and after sea-going duties in the Far and Middle East, he carried out research on fuel combustion at the Admiralty. He left the Navy with the rank of Lieutenant (E), R.N.

In 1947 he joined the Plastics Division of Imperial Chemical Industries Ltd.; there he remained until his appointment to Metal Box. His group at Welwyn were responsible for many brilliant studies, including work on energy concepts in extrusion, high speed/high throughput extrusion, injection moulding sugar-fine powders and other topics.

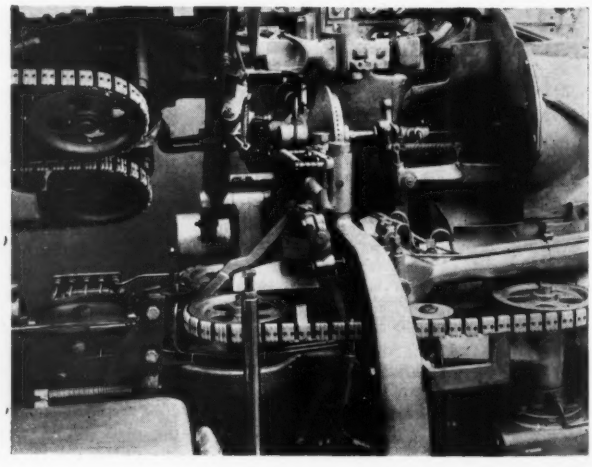
He has made many contributions to the technical literature on high polymers, including a chapter in the new work by Butterworths "Modern Trends in Surgical Materials." He is an associate member of the Institution of Mechanical Engineers. I wish him well in his new field of activity.

* * *

Plastics Application.—The illustration below is a section of the latest and most up-to-date machine of the genus *Pisces Ostectomy*. Readers will note the extensive use of plastics in this machine. Nylon, p.v.c. and other plastics are strategically employed where conditions make metallic or rubber surfaces unsatisfactory. For the record the machine is manufactured by Baader of Lubeck, West Germany, and was shown at the International Shipping and Commercial Fishing Exhibition held in Hull last month. The work the machine does can euphemistically be described as fish preparing and I think that for such an occupation, plastics are ideally suited.

PLASTIKON.

(Above) A *Coronet Explorer* makes her way triumphantly past the Statue of Liberty after crossing the Atlantic from Copenhagen. Ole Botved, Danish skipper and builder of the craft, credited the polyester resins supplied by Reichhold Chemicals, Inc., for the toughness and flexibility of the hull which withstood the battering of the heavy seas. He said that a $\frac{3}{16}$ inch layer of polyester-fibrous glass bonded to plywood makes "an unbeatable combination"



New Productions

Replacement for Linoleum

A new flexible vinyl flooring, intended as a replacement for linoleum, is announced by Semtex Ltd., the Dunlop subsidiary.

Supplied in sheet form and reinforced with asbestos for extra strength, Semtex Vinyl Flooring has a smooth close-knit surface, which is non-slip, impervious to moisture and easy to clean. It is also resistant to fats, grease, oil and alkalis. The backing is impressed with a cloth weave to provide a good key and to prevent sliding. Other advantages are its high resistance to indentation; its light weight, making it easy to carry and to handle; and its non-inflammability.

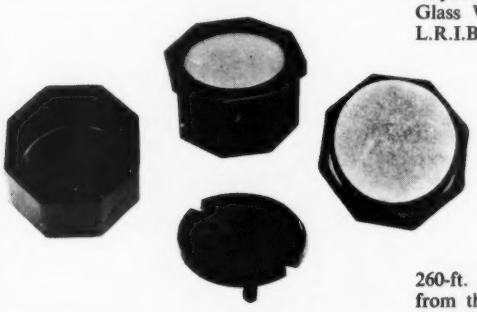
To keep the flooring clean, a light mopping with soapy water is all that is necessary, although a wax based polish can be used if required.

Semtex Vinyl Flooring, which is compounded with non-fading pigments, is available in a range of 14 different colours. Prior to launching on a national basis, it is being introduced in the Leicester area with a view to testing local reaction.

Mercury Collector

This is another addition to the range of Polysyn plastics laboratory ware. It consists of an hexagonal polythene container with a screwed top, a polythene tray and a threaded polythene lid with an inserted plastic foam pad.

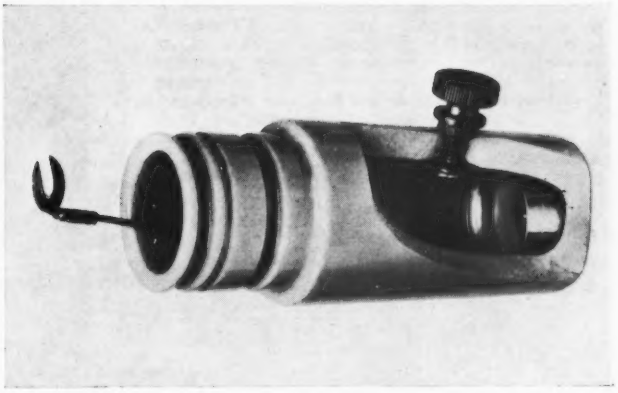
To collect mercury accidentally spilled, the lid and foam pad are removed from the container and pressed firmly against the surface or the table on which the mercury has been spilled in such a way that all or some of the mercury globules are properly covered. The pressure applied will open up the cells in the foam pad so that the individual globules can enter the opened-up cells. They will close up once pressure is released and the lid can then be screwed back into the container. The pressure created by closing the container is sufficiently strong to reopen the cells in the foam pad and to release the mercury, which will collect at the bottom of the container.



Polythene and polyurethane materials are used in the manufacture of this mercury collector.

Helmets

Illustrated is a group of helmets moulded by Universal Metal Products Ltd., for Messrs. Helmets Ltd. The helmets marked "A" are specially designed for issue to Colonial Police Forces and are manufactured in light blue, dark blue and maroon. These are made in four sizes. The helmet marked "B" is a protective helmet for the tropics, made in off-white. The specimen marked "C" in olive drab is the conventional Army helmet type. Specimens marked "D" are miners' helmets, two sizes, made in black and white. All are made by the matched-metal process using preforms produced from glass-fibre, and have the advantage of very light weight combined with great strength.



Bakelite epoxy resins have been used for this insulating pot for neon signs.

Epoxide Resin Used in New Neon Sign

Over 1,000 insulating pots, incorporating Bakelite epoxide resin in place of more traditional potting materials, have been used in the construction of what is believed to be the longest neon sign ever erected in Great Britain. The new sign, designed and built for Hampton's Depositories, Battersea, by Rada Scientific Glass Works (Architect: Herbert L. Smith, L.R.I.B.A., A.M.I.Struct.E.) comprises two 260-ft. span fluorescent signs built 100 ft. from the ground and Bakelite epoxide resin was chosen by the designers to meet the stringent weathering properties and electrical stability required.

Rada Scientific Glass Works employ the unusual practice of leading the high tension connection inside each letter. This necessitates a side terminal halfway up the pot and the high degree of insulation required between the H.T. terminal and the fixing screw at the base of the pot was achieved by mixing the specially developed Bakelite epoxide resin and cold-setting hardener and pouring the mix into the base of each pot. The potting material, in addition to its insulating and good weathering characteristics, also served to hold the fixing screw firmly in the base of the pot.

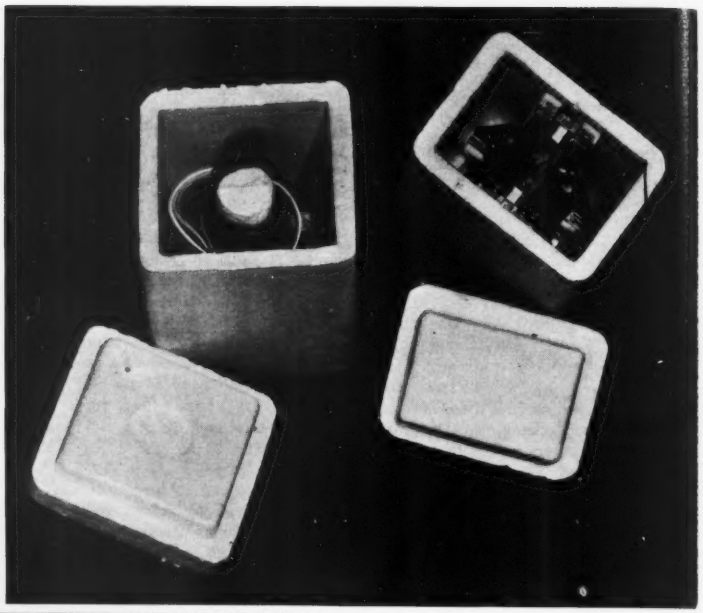
Polythene Cistern Ball Float

A new polythene cistern ball float is announced by Ekco Plastics Ltd. Light in weight, robust and completely non-corroding, the Ekco float has a virtually unlimited life in cold water under even the most severe conditions. Measuring 4½ ins. in diameter, it is finished in black and fully conforms to BS 2456.

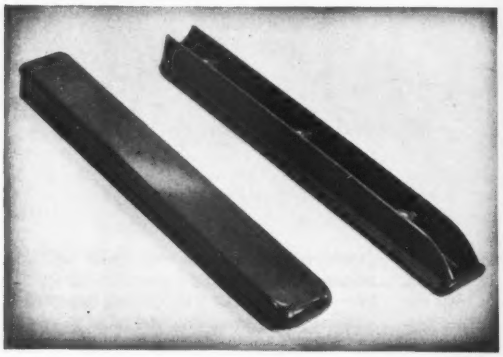
(Above) Butter block hood formed from Perspex for Sainsbury Ltd. by General Plastics Ltd., Patterden Lane, Marden, Kent.

(Below) Glass fibre helmets moulded by Universal Metal Products Ltd.

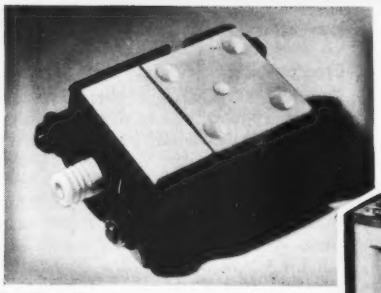
(Right) A new range of containers, specially designed to hold delicate electrical components, is now being manufactured by Miday Plastics Ltd. (34 Hoxton Square, London, N.1), using Distrene X expanded polystyrene.



(Below) Nylon elbow rests for Swiss railway carriages moulded in Grilon nylon.



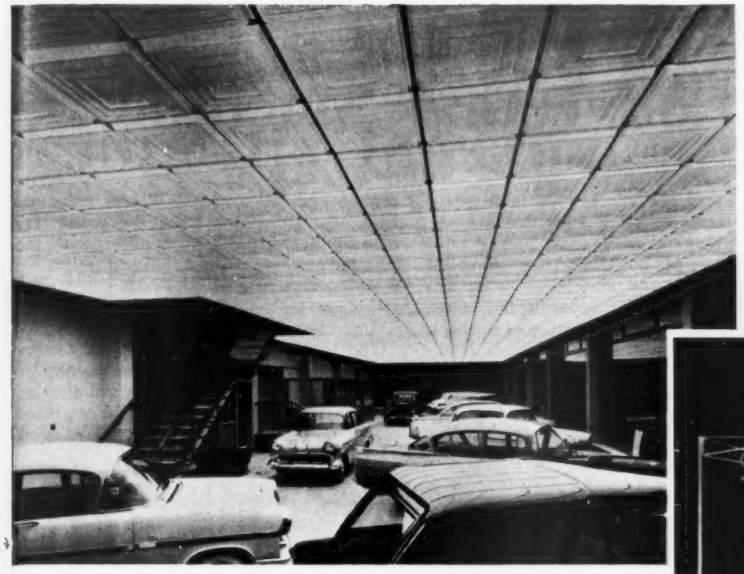
(Right) A new valve introduced by the Chemical Pipe & Vessel Co., Ltd., Godstone Road, Kenley, Surrey, should be of interest to chemical engineers as it can be used for corrosive and hot liquids. The valve is made from p.t.f.e., and can be used for strong sulphuric acid, strong nitric acid and hot ferric chloride. It will withstand temperatures up to 200° C.



(Below) An 18-month record of no transit damage for Aeropreen-packed scientific apparatus is reported by Ernest Turner Electrical Instruments Ltd. The company claims that as a packaging material, Aeropreen polyester urethane flexible foam plastic demonstrates a high shock absorbency. Aeropreen is made by Aeropreen Products Ltd., Lindsay Avenue, High Wycombe, Bucks.

(Below) Colourful new reinforced-resin litter bins made from Bakelite polyester resin are supplied by Elton Civic Supplies Ltd., of Aylmer Parade, London, N.2. These new plastics litter bins need no maintenance, will not buckle or dent and cannot cause unsightly rust-marks on concrete lamp standards.

(Right) Foamedge weatherstrip is manufactured from polyurethane foam, p.v.c. covered in white or grey. A special high-speed welding machine has been installed by the manufacturers, Lintafoam (Sales) Ltd., P.O. Box 25, High Wycombe, Bucks., in order to produce this material.

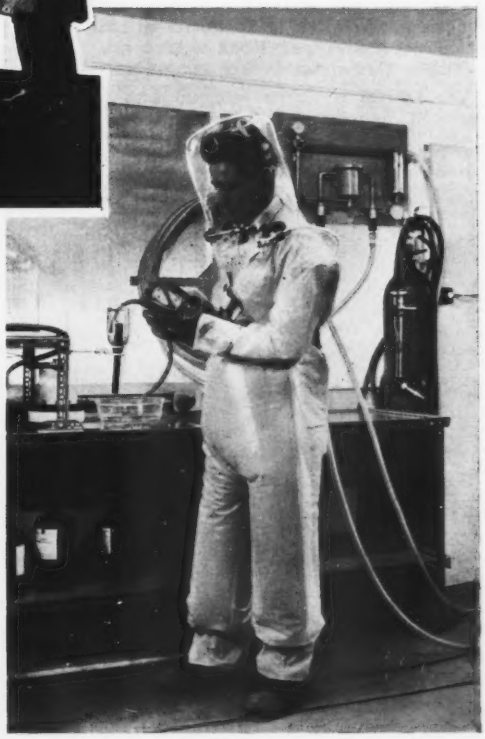


(Left) One of the first major lighting schemes to be carried out jointly by Lumenated Ceilings Ltd. and The General Electric Co., Ltd., has been completed recently in the new automobile showrooms of the Scottish Motor Traction Co., Ltd., at New City Road, Glasgow. It consists of an overall false ceiling of 934 decorative vinyl Lumenator Module panels—each 2 ft. square—suspended in an aluminium framework 2 ft. 3 in. below the structural ceiling.

(Below) At the Commercial Motor Show and the Motor Show, the exhibits of the Sheepbridge Engineering Group will be housed in a novel Flying Saucer which has been made by the Plastics Division of the Group from polyester resin reinforced with glass fibre.

(Below) The London Salvage Squad are changing to lightweight Terylene p.v.c. coated salvage sheets instead of their previous proofed canvas salvage sheets. The sheets are 12 ft. x 18 ft. and are in a 10-oz. cloth manufactured by Armoride Ltd., Grove Mills, Colne, Lancs.

(Below) A new type of protective suit made with Geon p.v.c. sheeting has recently been introduced jointly by Spembly Ltd., Manor Road, Chatham, Kent, and Plysu Products Ltd., Woburn Sands, Bletchley, Bucks.



(Below) These three all-purpose rigid polythene jugs have just been introduced into the Bex range of housewares. Useful for carrying any liquids, they are attractively designed and come in three sizes, with 4 pint, 8 pint and 12 pint capacity.

Machines for the Industry

Plastic Film Converting Machine

ONE of the most interesting and most versatile converting machines of recent years has come on the market in the form of the Unimat. Originally only offered to the market as automatic bag making equipment, this machine has proved itself capable not only of the manufacture of all kinds of bags, but also for the continuous production of a great variety of flat types of containers and protective covers.

The Unimat is at present one of the most reliable pieces of equipment on the market for producing and sealing polyester films such as Melinex, Mylar and Hostaphan. This is achieved by means of the unique construction of exchangeable sealing jaws, using a modified hot wire cut-seal method. This method does not work against a flat lower jaw surface, but is in such a manner that the hot wire or band disappears through the film into a groove in the lower jaw simultaneously pressing the hot beaded edge obtained by the standard cut-seal operation into a narrow flat pressure moulded seam.

The same method also offers an opportunity of making much neater and clean flat seams using materials such as High Density and Ziegler-polythene films and the new type of high burst strength and prestretched Ziegler-polythene grade V 57.

The jaws of the Unimat of 600 mm. standard length are easily exchanged for standard heat sealing jaws, impulse welding jaws, or HF electrodes in which latter case an additional HF generator can be fitted to the standard equipment. This can be controlled by the electric programme-control unit which forms part of the Unimat automatic equipment.

The Unimat is further equipped with a photocell control governing the programme-control, if so desired, and with a stageless roller type feed indexing the width or length of the bags or shapes being produced.

A wide range of easily exchangeable units and accessories can be fitted between the actual sealing appliances and the support for the film reels. These additional accessories make possible the automatic production of slit-bags, turn-over flaps, bottom gusset bags, book-covers, perforation across and with the web, sealing with the web as well as the fully automatic production of draw-string bags and self-sealing bags with simultaneously applied adhesive tape closures. The feeding supports are fitted with guide rollers, folding unit and accessories to run lay-flat tubing, one reel of film or two superimposed reels simultaneously.

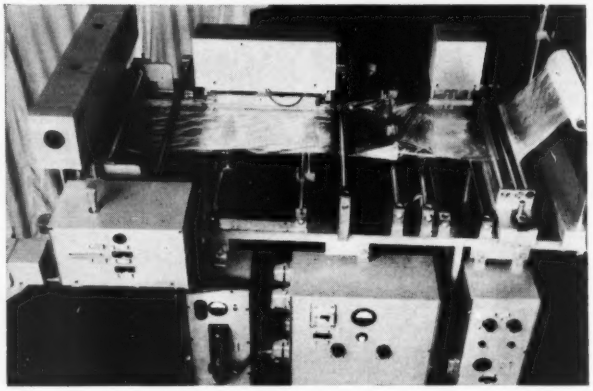
The programme-control can be adjusted to work all movements in two, three and four second cycles. An additional one second cycle control is available on request for simple standard polythene bags. This means that the Unimat would produce, for example, in two seconds one 600 mm. wide Ziegler polythene bag or the equivalent quantity of bags smaller than 600 mm. without taking into account the adjustable length of the finished article in direction with the web.

Variety of Materials

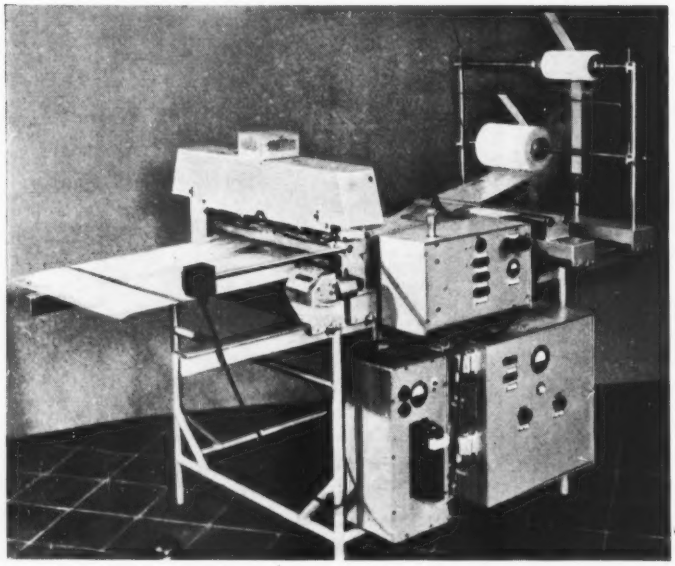
The Unimat has proved itself satisfactory for the manufacture of bags, and sachets or water soluble p.v.a. films, laminates such as polythene coated cellulose films and polythene coated polyester films and other varieties of laminated film combinations.

For materials, which, according to their properties, cannot be converted using hot wire cut-seals or tear-seals, the Unimat is equipped with an additional cross-cutting appliance that cuts the wide seam welds, produced by heating band jaws or impulse sealing jaws, through the centre in step with the programme-control governed movements.

It is of interest to know that the Unimat equipment, which is of German design, is at present assembled in this country partly from British made and partly from German made parts, but arrangements have been made to produce the complete equipment in the near future entirely in this country, and the British manufacturers have also acquired the right to produce this equipment for the world market except Germany and Scandinavia. By this arrangement the Unimat is likely to become an interesting addition to the British export market for conversion equipment for plastic films. At present the demand is well above the production capacity and sales are made according to a priority list. In the U.K. the Unimat is shown in the demonstration rooms of Kemitype Ltd., 8 Chase Road, London, N.W.10.



The Unimat equipped for the automatic production of draw-string bags.

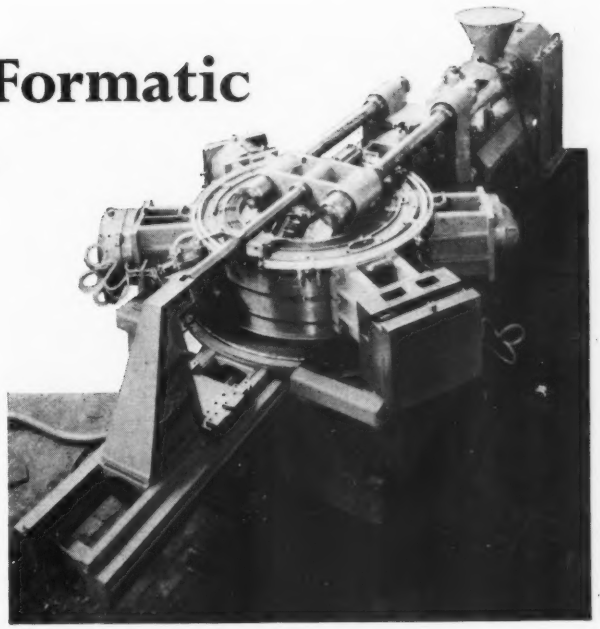


The Unimat converting machine showing the control panel and sealing jaws.

Machines for the Industry

The Troester Extr-a-Formatic Automatic Injection Moulding Machine

Details are given below of this unconventional injection machine which was shown for the first time at Hannover this year. Many novel features will make it of interest to moulders who demand a large capacity and high productivity. The Troester machine is sold in the U.K. by F. J. Edwards Ltd., 359 Euston Road, London, N.W.1.



The Troester Extr-a-Formatic showing the mould carrier. In this photograph one mould has been removed so as to show the table more clearly.

IN the June issue of *Plastics* we reported some of the new plastics machinery exhibited at Hannover including the Troester Extr-a-Formatic automatic moulding machine. We are now able to give readers a more detailed report of this interesting and unconventional moulding press.

The Extr-a-Formatic is a combination of an extruder and an injection moulding machine in which the extruder screw acts both as a plasticizer and as the transferring agent for filling the mould cavity. In this way, it is claimed, the plastic material is more uniformly heated and is more homogeneous so that lower pressures can be used for injection and mould closing. The mould unit can be fitted to either the E.P.90 or the E.P.120 Extruders having plasticizing capacities of 265 and 550 lb. per hour respectively under these conditions. The maximum shot or moulding which can be produced is 6½ lb. or 160 cu. in. (dependent on material and mould design), the minimum shot is 3 oz.

The mould unit consists basically of a rotating table upon which are fitted the moulds. Up to 24 separate moulds depending on their size, can be accommodated on the table, each of which may be different to its fellow. Although it is advisable to try and maintain a certain equality in the injection capacity for each mould varying cycle time can be set for each station. Two factors should, however, be borne in mind when using the Extr-a-Formatic to mould different components. Firstly no colour change can be made and secondly mould heights should be the same.

The Extruder is connected to the revolving moulding unit by means of four stay bolts fitted to the front platen of the unit. By loosening these four nuts the unit which is mounted on rails may be withdrawn for cleaning the extruder or changing the screw.

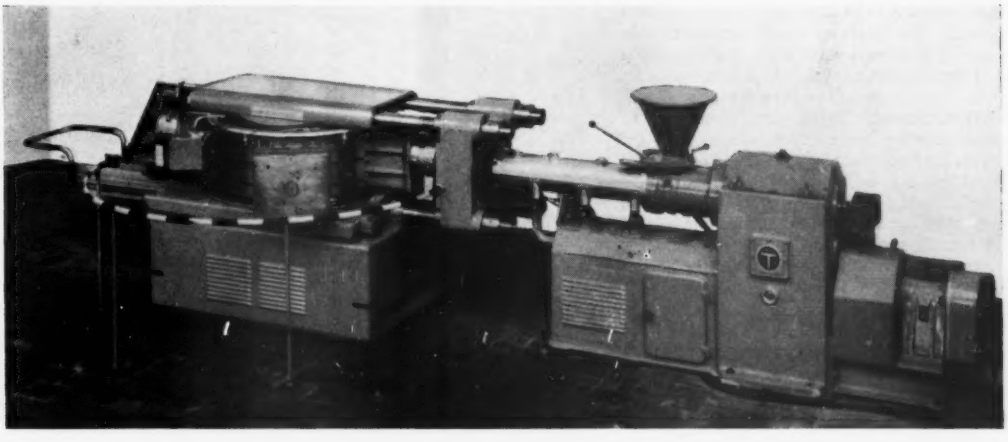
The front platen is connected to the main frame of the moulding unit by four robust longitudinal tie bars. The height of the moulds to be inserted may vary between 16 in. and 25½ in. and in order to compensate for this variation the front platen may be adjusted in a longitudinal direction on these tie bars.

The revolving table carrying the moulds has a fixed centre and as the mould reaches the injection station, at the extruder head the table is moved towards the extruder giving a positive seal for injection. This same movement also, at the opposite side of the table provides the initial opening of the mould at that station. On completion of injection the table moves back and in this way provides a sprue-break mechanism. This table movement is performed by a hydraulically operated toggle mechanism situated in the centre of the table.

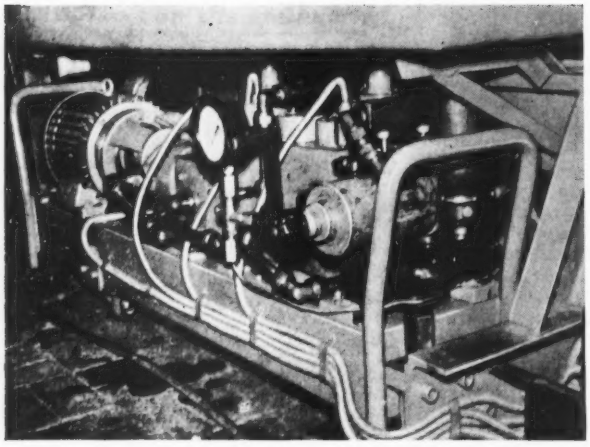
Each mould is mounted on a special support and should be cored for the circulation of heating or cooling fluid. This is supplied to the moulds through flexible tubing, by an electric circulating pump situated in the base of the unit. The temperature of the fluid is thermostatically controlled.

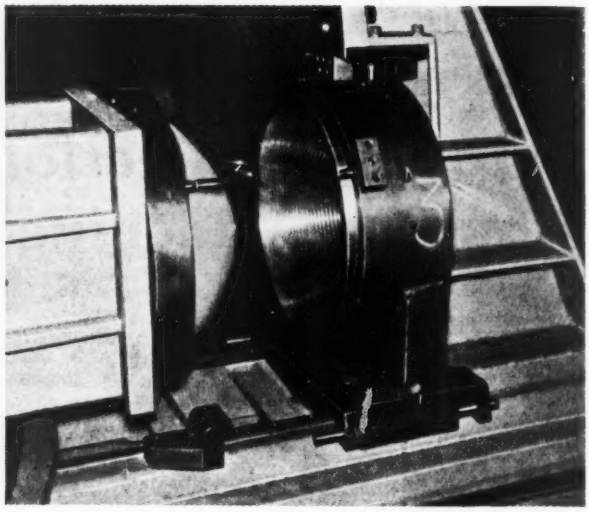
The hydraulic unit is situated in the base of the machine and consists of a 7½ h.p. electric motor flanged to a gear pump giving a pressure of 1,400 p.s.i. to the two hydraulic cylinders that operate the toggle mechanism and the mould opening mechanism. The complete unit is mounted on rollers and can be withdrawn so that servicing can be quickly and more easily accomplished. The removal of the hydraulic unit serves a second purpose in that it makes the turntable driving mechanism readily accessible.

Opposite the injection station is the mould opening and ejection mechanism. When the mould reaches this station attachments to the outer half of the mould engage with their



The Troester extruder and moulding unit with control cabinets which make up the Extr-a-Formatic.





(Above) The hydraulic unit which is mounted on rollers.

(Right) Mould opening showing the carrier and interlock mechanism.

counterparts on a carrier. The movement of the table by the toggle mechanism mentioned in a previous paragraph disengages the mould lock and provides an initial opening movement. Full opening is obtained by the carrier and outer mould half being withdrawn by means of a hydraulic ram. This gives ample daylight for moulding extraction. Mechanical or pneumatic ejection of the moulding is done by controls fitted to the table.

The Extr-a-Formatic can be fully-automatic in operation or hand controlled. In the latter case the various operating sequences are controlled by push buttons from the control cabinet. Relay switches control the injection time for each individual mould and give times ranging from 1½ seconds to 30 seconds. The electro magnetic control valves as well as the geared, drive-and-brake motor are operated by limit switches tripped by adjustable cams. In this way each mould has an individual programme which can be set independently of the other moulds according to the product moulded. Should the injection time be short and the opposite mould require a long open period, for the fitting of inserts, for example, a dwell time can be incorporated in the programme. In this way a balance can be maintained between the various factors which will arise when different products are produced on the same run.

Plasticizing capacity with EP.90 ...	265 lb./Hr.
Plasticizing capacity with EP.120 ...	560 lb./Hr.
Maximum injection per mould	160 cu. in.
Injection pressure	4,267 lb./in.²
Mould closing pressure	250 tons
Mould opening pressure	30 tons
Maximum mould area (between tie rods)	16in. × 20 in.
Maximum mould depth	20 in.
Line pressure	1,250 lb./in.²
Output of motor (hydraulic drive) ...	7.5 h.p.
Output of motor (revolving table) ...	2 h.p.
Heater for pre-heating of cooling medium	4.5 kW.

A New H.F. Pre-Heater

THE 500 W. H.F. Dielectric Heater was originally developed by the Electronic Division of MM. Hasler S. A. Berne, Switzerland, for use in the production of the millions of mouldings required in the manufacture of their telephone and telecommunication equipment, a field in which they are Switzerland's oldest and largest organization, being founded in 1852. The heater operates at a basic frequency of 40 Mc/s. This frequency was employed after exhaustive tests, and results have shown it to be conducive to fast and even heating. Its operation is fully automatic, the oven lid opening and the timer resetting at the end of each heating cycle. To ensure foolproof operation by unskilled personnel the circuit incorporates many safeguards. These make it impossible for current to be drawn from the valves before the correct "warming up" period has elapsed, protects the oscillator valve against damage caused by drawing too much current on the anode circuit. A built-in filtered air blast is supplied for cooling the oscillator valve, and ventilating the interior of the heater.

The front-panel has two pilot-lamps. One lamp (green) lights up as soon as the heating to the valves is switched on. The other (red) lights when the whole apparatus is in operation. At the lower right is situated a measuring instrument which indicates the anode current of the oscillator valve TB 3/750. The oscillator valve is protected from overload by a maximum-current relay. The limiting current is indicated by the red mark on the instrument scale (approximately 450 mA.).

At the centre is situated the time switch. With the help of this switch the warming-up time can be adjusted. The time switch is provided with two ranges: 0–30 sec. and 0–5 min.

The mains switch is a small automatic device with electromagnetic rapid-release and thermally-delayed over-current release which serves to protect the apparatus.

Further details of this heater can be obtained from the British agents, Hasler Telegraph Works, Ltd., 26 Victoria Street, London S.W.1.

The Hasler dielectric pre-heater developed in Switzerland.

Plastics News

Plant and Equipment, Materials, Processes, Company News, Technical Literature, Exhibitions, Personal Notes and Meetings.

SLITTING AND RE - WINDING MACHINE.—The machine shown in the accompanying illustration is made in three sizes, viz., for material up to 25 in., 46 in. and 58 in. wide. It is a self-contained unit. The two side frames are strongly braced apart and the controls are within easy access of the operator. The machine can be mounted on a stand if required for floor mounting, otherwise it can be used as a bench model. It is driven by an ½ h.p. motor giving a running speed of 75 ft. per minute. Controls comprise "stop," "start" and "inching" buttons. The drive is taken to a rubber covered pull through roller and the two re-wind shafts. The latter have individual frictions and an adjustment for varying the tension on the re-wound coils.

Ordinary three-hole razor blades are used for cutting. These are secured in special holders mounted on a separate shaft. These holders are held in place by knurled headed grub screws; they can therefore be easily adjusted or swung clear when not in use. The slitting shaft is fitted with a quick release lever. The stock roll is mounted on smooth taper cones, one of which is spring loaded. These cones are stationary and the cores revolve around them. Tension is adjusted by regulating the spring loaded core. There is provision for fitting a stock roll adjustment which is sometimes necessary where badly wound rolls of material are encountered.

A counter can be fitted and if necessary it is possible to incorporate a device for stopping the machine after a predetermined length has been slit.

Plastics, cellulose acetate films, polythene, etc., has been slit satisfactorily and by fitting individual frictions on the re-wind shafts, variations in caliper across the web are taken care of.

This machine is now added to the range of other slitting and re-winding machines made by T. H. Dixon & Co., Works Road, Letchworth, Herts.

VACUUM DRYER.—The C-3 Type Vacuum Dryer is designed for drying low moisture content materials, granules, powders, etc., and it has been found particularly effective in the Plastics Industries. It has small independent compartments which enable drying to commence immediately one compartment has been filled and to continue uninterrupted whilst other compartments are being loaded and unloaded. This gives a semi-continuous operation and ease in handling as the doors of the vacuum chambers are quite small and the whole equipment can be operated quite easily by one man.

The dryer covers a wide temperature range from ambient to 150° C., and normally operates to a vacuum of 20 mm. absolute. It is possible to obtain a very much higher vacuum if necessary by the use of a suitable vacuum pump. For most purposes, however, a water ring pump or a reciprocating pump are quite suitable. It is heated by means of hot oil circulating between the compartments. An expansion tank is provided for taking up the fluid expanded by heating.

Standard sizes of production dryers are 2, 4, 6, 8 and 10 compartments and the tray area of each compartment is approximately 20 sq. ft. It is usual to operate the dryer with four trays in each compartment.

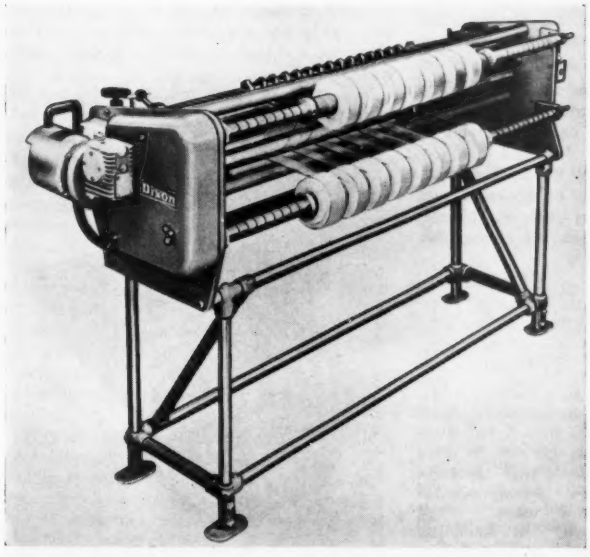
Further information can be obtained from Calmic Engineering Co., Ltd., Crewe, Cheshire.

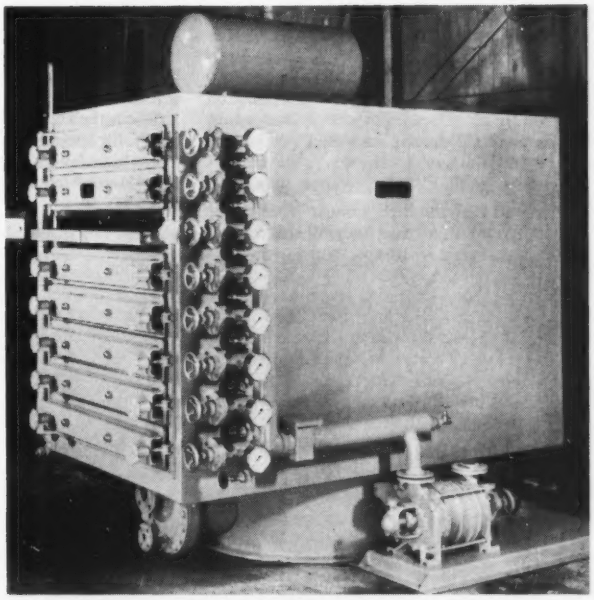
General

Butyrate Powder for Sinter Coating.—A recent introduction into the coating field is the Cellit sinter powder marketed by R. H. Cole & Co., Ltd., 2 Caxton Street, Westminster, London, S.W.1. This powder is a cellulose acetate butyrate material and is designed for coating by the whirl sinter process. The particle size of the soft grade is from 0 to 150 microns and the coat obtained has a practical heat resistance of about 100° C. The actual melting range of the powder is between 180° C. and 190° C. The high temperature required for the pre-heating of the material to be coated (between 320° C. and 360° C.) means that care must be taken to ensure that it will withstand these temperatures. Soft soldered pieces, for example, will not be suitable for coating.

Price Reduction.—Geigy, who have been manufacturing sebacic acid in this country for the past 10 years and recently extended their sebacic acid plant at Trafford Park, now announce a reduction in the price of sebacic acid. The reduction, which took effect from September 1, 1958, amounts to 4d. per lb., and it lowers the list price of sebacic acid from 6s. 2d. to 5s. 10d. per lb.

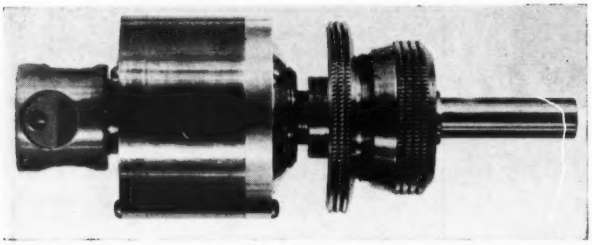
At the same time Geigy are reducing the prices of diester and polyester plasticizers manufactured from sebacic acid. Reductions on the Reomol sebacate diester plasticizers vary from 2d. to 2½d. per lb., and those on the





(Above) The C 3 vacuum dryer manufactured by Calmic Engineering Co., Ltd.

(Left) The model 537 slitting and re-winding machine manufactured by T. H. Dixon & Co.



(Above) The H.E.D. tapping attachment manufactured by Headland Engineering Developments Ltd., 46 Lower Marsh, London, S.E.1.

Reoplex polyester plasticizers from ¾d. to 2¾d. per lb.

Key Industry Duty.—The Treasury have made an Order under Sections 10 (5) and 12 (2) of the Finance Act, 1926, terminating the temporary exemption from Key Industry Duty of imports of dimethylamine.

Hand Roller.—The Richard Maurice Equipment Co., of Portsmouth Road, Cobham, Surrey, have produced a new hand roller for the hand layout of glass reinforced laminates. This roller employs a coil spring instead of the more conventional spaced and split washers and has the advantage that it does not easily clog, it is easily cleaned and the spiral of the spring gives a slight side-ways motion to the resin when in use.

Phthalocyanine Blue.—Geigy have now completed the first stage in their programme of manufacture of phthalocyanine blue in this country. The modern plant built exclusively for this purpose at their Paisley works (James Anderson & Co. (Colours) Ltd.) has been in operation since last year and has shown that the phthalocyanine colours can be produced satisfactorily and consistently. Four different standards of copper phthalocyanine blue are available.

Price Reductions.—Substantially lower prices for "Araldite" epoxy resins have been announced by Ciba (A.R.L.) Ltd. The reductions have followed immediately upon the completion of a new epoxy resin factory at Duxford with a greatly increased production capacity.

Spark Testing Equipment.—The spark tester is unique in that the high voltage generator is located inside a small case integral with the test electrode. This Electrode Head may be mounted remotely from the Control Cabinet to which it is connected by a low voltage cable. The test voltage is of a high frequency, and is entirely safe; it is continuously variable between 0 kV. and 25 kV., and it is indicated on a built-in meter.

The detecting circuit involves an electronic storing circuit, capable of operating a conventional relay and magnetic counter from the very short pulses received upon the passage of a fault at the highest wire speeds. The exceptional fast response of the equipment permits the use of an electrode only 3 in. in length. This affords the advantages of resolving closely spaced faults, without the risk of multiple counting of the same fault, thereby resulting in a greatly improved accuracy of fault detection Other advantages are the saving in space, ease of mounting and reduced cost.

The Control Cabinet further incorporates a two-way selector switch by means of which the signal relay may be operated (*a*) in a latching mode, requiring the pressing of push-button for cancelling the signal, and (*b*) in a self-cancelling mode, wherein each fault will actuate the signal relay once. In either case, the number of break-downs are registered by a magnetic counter, up to a maximum count of 999,999. The maximum speed of the counter is 800 faults per minute. For fault occurrences in excess of this, an electronic counter would have to be used.

Further details can be obtained from The Addison Electric Co., Ltd., 10/12 Bosworth Road, London, W.10.

Extrusion Machinery Order from Jugoslavia.—Fawcett Preston & Co., Ltd., of Bromborough, Cheshire, have received an order from Fabrika Kablova, Svetozarevo, Jugoslavia, for extrusion machinery worth just over £50,000.

This is the second order Fawcetts—a member of the Metal Industries Group—have received from Jugoslavia's biggest cable factory. The first, announced last January, was valued at £25,000.

Vinyl Copolymer Resin for Solution Coating.—The properties, compounding and applications of Geon 222 vinyl chloride/vinylidene chloride solution resin are discussed in a new Information Sheet issued by British Geon Ltd.

The outstanding property of this resin is its solubility in hydrocarbons such as toluene, xylene and aromatic naphthas; it is also soluble in ketones.

Coatings deposited from Geon 222 solutions withstand corrosion by acids and alkalis, salt water, oils and greases. They can be applied to a wide variety of surfaces by spraying, dipping, brushing and roll coating, and have excellent adhesion to metal, wood, paper and other materials.

Copies of the new publication, Information Sheet No. G.107, are available free of charge from Information Department, British Geon Ltd., Devonshire House, Piccadilly, London, W.1.

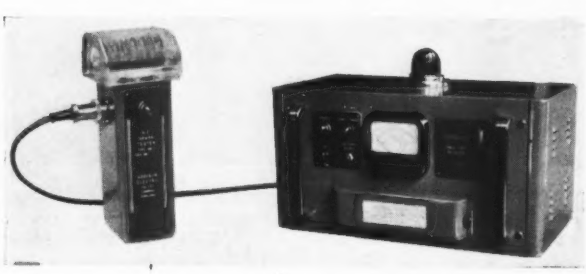
Speed Reduction Pulleys.—The Andantex speed reduction pulley has been created for direct mounting on to the driven shaft. Basically designed on the familiar sun and planet gear system, it has many advantages over the conventional method and is, in fact, a standard reduction unit.

The most revolutionary feature of the Andantex unit is the unique and previously unknown method of keying the planet pinions to their respective shafts. This method has been invented mainly to overcome the difficulties experienced in equilibrating the load when more than one multiple gear train is fitted round the central sun gears.

In the patented method used for the Andantex pulley the reduction unit is permanently assembled. The pinions are mounted on their shafts and left free to rotate so that they can take up their natural position. Special adaptors are used in the position of the planet shaft bearings thus enabling the planet gears to be pre-loaded and set in their correct position in relation to the central sun gears. This assembly now forms a mould which is pre-heated and nylon is injected by a specially designed nylon injection press. The adaptors are then removed and the correct bearings inserted.

Slight elasticity in the nylon allows the bearings to give the pinions sufficient working clearance and thus equilibrates the load upon them.

The range of speed reduction obtained by using the Andantex unit is very varied—in fact



(Left) The Addison spark testing equipment.
(Right) The Andantex speed reduction pulley.

21 set ratios are available ranging from 2.79 : 1 to 273 : 1 in cases where the driven shaft rotates in the same direction as the driving shaft. When the driven shaft rotates in the reverse direction the range is from 1.79 : 1 to 272 : 1.

The reduction pulleys are made in various sizes to transmit horse powers up to 80. They are designated by the degree of torque they will transmit. Sole licensee for the manufacture and sale in the U.K. and Commonwealth Countries is Furnival & Co., Ltd., Reddish, Stockport, Cheshire.

Price Reduction.—Geigy announce that they are able to make a reduction of £15 per ton in the price of tri-xylyl phosphate (TXP). The new prices for this product range from £201 per ton for 10-ton tanker deliveries to £211 per ton for single 40-gallon drum deliveries.

Company News

R. H. Windsor Ltd.—In his report to the shareholders, the chairman of R. H. Windsor Ltd., Mr. A. G. Dennis announced a Group profit for the year ended March 31, 1958, of £118,170. This is an increase of just over £13,500 on the 1957 figures. A dividend of 20% less tax was recommended.

Algemene Kunstzijde Unie N.V. and Staatsmijnen in Limburg are to institute a joint sales organization for plastics (Verenigd Plastic-Verkoopkantoor N.V.). The new company, which will be established at Zeist, will be charged with the selling of plastics; both at home and abroad. AKU will entrust to this selling bureau the sale of Akulon products which have so far been sold directly by AKU, while Staatsmijnen will transfer to it the sale of their new basic material for the plastics industry, polythene, which will be sold under the name of Stamylan.

AKU and Staatsmijnen will add to the sales organization a laboratory for application research and technical service. Know-how and experience gained will be made available to Akulon and Stamylan processors.

Drs. M. J. van der Hoeven will be appointed director of the Verenigd Plastic-Verkoopkantoor while **Drs. J. Zittersteijn** will direct the activities concerned with application research and technical service.

Alfred Herbert Ltd., of Coventry, have been appointed Sole Selling Agents in the United Kingdom and Eire for the Planing Machines and Equipment manufactured by Planers (Huddersfield) Ltd.

France's New Synthetic Rubber Plant.—The first plant in France for the manufacture of styrene/butadiene rubber is to be built at Berre near Marseilles. Three companies will be concerned in this development, Shell St. Gobain (in which the Royal Dutch/Shell group of companies has a 60% interest), Michelin, and Cabot-Texas Butadiene.

The new plant, which will have a capacity of 50,000 tons per year, is to be situated in the vicinity of the Shell Berre refinery, the St. Gobain chemical plant and the Cabot carbon black plant, from which sources it will draw its raw material. Production is expected to begin in 1961.

Dexion Ltd., manufacturers of Dexion Slotted Angle, have extended their activities to the Plastics Industry. Recently, they took over from Ashdowns Ltd., Undulite—translucent glass-fibre reinforced roofing and cladding materials.

Dexion Ltd. has set up a new Department to handle all plastics projects at their Essex factory in Cartersfield Road, Waltham Abbey, and has appointed as Manager, **Mr. Cecil Waxman.**

Whiffen & Sons, Ltd.—The Executive and Sales Organizations of Whiffen & Sons, Ltd., are now concentrated entirely at their Loughborough factory. All enquiries and correspondence should, therefore, in future be addressed to them at their Willow Works, Derby Road, Loughborough, Leicestershire.

The Publicity and Advertising Department will remain in London at Fison House, 95 Wigmore Street, London, W.1. It will still be possible to contact members of the Sales Organization through Fison House.

Reichhold Chemie AG., in Hamburg, have recently completed their own formaldehyde plant and have gone on stream. The annual production will be approximately 5,000 tons.

British Industrial Plastics Ltd. announce that it is their intention to manufacture in South Africa amino coating resins for the Paint Industry through their wholly owned subsidiary British Industrial Plastics (S.A.) (Pty.) Ltd. Production is not planned to commence before the Autumn of 1959.

Edward Emslie & Co. has been formed for the manufacture of barrel finishing materials for both plastics and metals. The company has been formed by **Mr. E. Emslie**, who was until recently Sales Engineer for the Finishing Division of Lacrinoid Products Ltd., and **Mr. F. Fallows**, who was until recently in charge of manufacture and development for the same division.

A.C. Plastics Industries Ltd. have moved from 231 Old Street, London, E.C.1, to new offices at 1–3 Longs Street, London, E.2.

Conferences

International Symposium on Plastics Testing and Standardization.—This is to be held immediately following the fall meetings of ASTM Committee D-20 on Plastics at the Benjamin Franklin Hotel in Philadelphia. The programme comprises four sessions to be held on Thursday and Friday, October 30 and 31, 1958. The symposium is being sponsored by ASTM on behalf of the American Group for the International Organization for Standardization (ISO) Technical Committee 61 on Plastics. The proceedings will be published by ASTM. The symposium will be followed by the 8th plenary meeting of the ISO/TC 61 on Plastics to be held in Washington, D C., November 3 to November 8.

Training Courses in Polarography.—Full-time and part-time courses in Polarography will be available during the session commencing November, 1958.

The object of the courses is to provide basic training in the theory and practice of Polarography. Lectures and practical training will be so arranged that attendance on only one or two consecutive days per week is necessary, but some private study is desirable. Further details may be obtained from the Secretary, British Polarographic Research Institute, 55 Oriental Road, Woking, Surrey.

Design Conference.—On November 12 the Council of Industrial Design in collaboration with the Birmingham Exchange and Engineering Centre, is sponsoring a one-day conference, "Industrial Design and Engineering Industries," at the Birmingham Exchange and Engineering Centre.

Exhibitions

I.C.I. Nylon Industrial Exhibition.—I.C.I. Plastics Division are holding two exhibitions in October to illustrate the industrial uses of nylon. The exhibitions, which will be seen in Cardiff and Glasgow are designed to show engineers and designers some of nylon's most recent industrial applications. Most of the exhibits will be injection moulded, but a number of articles produced by extrusion and other techniques will also be on show.

The first exhibition will be held at the Angel Hotel, Cardiff, on October 14 and 15 and the second at the Grand Hotel, Charing Cross, Glasgow, on October 29 and 30.

The Second International Hospital Equipment and Medical Services Exhibition will be held from May 25 to May 30, 1959, at Olympia. The Exhibition will be sponsored as before, by the Institute of Hospital Administrators and their official organ *The Hospital.*

Personalities

P.I.G.S.—The following are the results of the P.I.G.S. meeting held at the Berkshire Golf Club, Ascot, on Thursday, September 18. Artid Trophy. Winner: P. Allen, net 71; runner-up: F. Garrett, net 73. I.C.I. Trophy. Winner: P. Allen, gross 77; runner-up: F. Garrett, gross 78. Visitor's Prize: C. Chapman, net 74. Rootes Prize. Winners: P. Allen and J. Lennard, 43 pts.; runners-up: R. Johnson and A. Dormer, 36 pts.

During their visit to the works of Tufnol Ltd., some of the delegates to the International Symposium on Microchemistry show interest in the production of Tufnol gear wheels.

Mr. G. Stimpson.

Mr. G. Veit.

Mr. E. G. Pickering.—It is with regret that we hear of the death of Mr. E. G. Pickering, Joint Managing Director of Johnson, Matthey & Co., Ltd.

Mr. C. I. Rutherford has been appointed a Director of the Fibres Division of Imperial Chemical Industries Ltd. In 1951, Mr. Rutherford first became associated with Terylene when he joined the Technical Department of the Terylene Council. He was appointed Manager of the Terylene Pilot Plant at Hillhouse in 1953, a post which he held for three years. Mr. Rutherford came to the Fibres Division headquarters in 1956 as Assistant Research Manager, and in 1957 was appointed Production Manager, a post which he held until his appointment to the Board of Fibres Division.

Monsanto Appointments.—Monsanto Chemicals Ltd. announce the appointment of **Mr. D. C. M. Salt** to the newly created post of general manager in charge of Chemicals Division, and of **Mr. G. Dodd** to the corresponding post of general manager in charge of Plastics and Special Products Division. Both general managers will be responsible to the managing director, Mr. D. R. Mackie.

The appointment of Mr. Dodd to his new post leaves his present position as controller of purchases vacant. **Mr. J. V. Head** is consequently appointed acting controller of purchases.

Microchemistry Delegates Visit Tufnol Ltd.—During the recent International Symposium on Microchemistry, held at Birmingham University, a party of delegates paid a visit to the Works of Tufnol Ltd. in order to see at first hand the manufacturing processes and uses of modern resin-bonded laminates. The party, was led by Dr. B. B. Bauminger.

British Titan Products Co. Ltd. announce the appointments of **Mr. N. D. Harris, Dr. P. A. Lintern** and **Mr. S. G. Tinsley** as Directors of the Company.

Dr. Lintern and Mr. Tinsley have been with the Company for many years. Mr. Harris was formerly Chairman of I.C.I. (India) Ltd.

Mr. W. H. Glass, O.B.E., who has been a director of Thermotank Ltd. for the past 25 years, has retired from the Board of the Company.

Mr. H. K. Scholes has been appointed an additional director of Ferguson Shiers Ltd. Mr. Scholes, who is an accountant has been with the Company since the reorganization in 1946 when he became Company Secretary. He is also the Secretary of the associated companies Springfield Mills (Radcliffe) Ltd. and Orbex Ltd.

Mr. A. P. M. Purdon has been appointed Operations Study Manager in charge of Central Operational Research and Work Study for the British Oxygen Co., Ltd.

Mr. Gordon Stimpson joined Styrene Products Ltd., an associate company of Shell Chemical Co., on September 1 to become technical assistant to Mr. David Crabtree, manager of the technical service department, and will be situated in the firm's Head Office in London.

Mr. G. Veit has relinquished his post as technical sales consultant with Warbrick (Engineering Specialities) Ltd. and has joined Ed. Brand Ltd. for an appointment of a more technical nature connected with British built Reifenhauser extrusion equipment.

Mr. A. Kennaway has resigned from his position as head of the Experimental Engineering Section of the Plastics Division of I.C.I. to become Assistant on Plastics to the Chief Technical Engineer of The Metal Box Co., Ltd. He is to form a new section to be responsible for the development of the technology required to fabricate plastics in the packaging field.

Board Changes.—George Kent Ltd. announce the appointment of **Mr. T. P. W. Norris** a former President of the Institute of Personnel Management, as Deputy Chairman.

They also announce that **Mr. R. E. Handford,** Deputy Managing Director, after 45 years in the Company's service, 25 of which as a Director, relinquishes his executive functions and retains his seat on the Board: that **Mr. W. A. Hartop** who joined the Company in 1927 and was appointed to the Board in 1943, has been appointed as the Managing Director: **Commander P. W. Kent** formerly Chairman and Managing Director, remains as Chairman.

On September 30 two Directors retired: **Mr. W. Guy Ardley** and **Mr. Leslie H. Kent.**

Mr. H. R. Ruddick has retired after 50 years service with Storey Bros. & Co., Ltd., having been Export Manager for the past 30 years. A complimentary dinner was held last month for Mr. Ruddick at which many of the overseas agents were present to honour him.

Dr. F. F. Jaray has been invited to read a paper at the S.P.I. Conference in Chicago. The paper will be on glass reinforced plastics in the chemical industry.

Meetings

October

14th.—"Thermoplastic Pipes"—an open forum. The London Section of the Plastics Institute, at the Wellcome Building, 183–193 Euston Road, N.W.1. 6.30 p.m.

15th.—"Polypropylene," by Dr. F. Ranalli and Ing. G. Crespi. The Midlands Section of the Plastics Institute, at the Grand Hotel, Leicester. 6.45 p.m.

15th.—"The Use of Paper in the Plastics Industry," by D. A. Knight. The North-Eastern Section of the Plastics Institute, in the Second Dining Room of the Eldon Grill, Grey Street, Newcastle. 7 p.m.

17th.—"Polypropylene," by Dr. F. Ranalli and Ing. G. Crespi. The Midlands Section of the Plastics Institute, at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3. 6.30 p.m.

22nd.—"Stelvetite," by F. H. Smith. The Scottish Section of the Plastics Institute, at More's Hotel, Glasgow. 7.30 p.m.

23rd.—"Plastics in the Boot and Shoe Industry," by J. Bunten. A joint meeting of the Western Section of the Plastics Institute, the Bristol Section of the Society of Chemical Industry, the Royal Institute of Chemistry and the Chemical Society, at the Technical College, Gloucester. 7.30 p.m.

28th.—"Vinyl Chloride Polymers: their Design and Application," by B. S. Dyer. The London Section of the Plastics Institute, at the Wellcome Building, 183–193 Euston Road, N.W.1. 6.30 p.m.

November

3rd.—"P.V.C. Coated Metals," by W. E. Martin. The Midlands Section of the Plastics Institute, at the Grand Hotel, Leicester. 6.45 p.m.

5th.—"Thermoplastics with special reference to the use of nylon in industry," by C. C. Morgan. The Leicester Branch of the Incorporated Plant Engineers, at the Bell Hotel, Leicester. 7 p.m.

6th.—Annual Luncheon of the London Section of the Plastics Institute, at the Criterion in Piccadilly.

7th.—"Plastisols," by D. A. Lever. The North-Western Section of the Plastics Institute, at the Textile Institute, Blackfriars Street, Manchester. 6.45 p.m.

12th.—Paper on Moulding and Extrusion Machinery, by E. Gaspar. The Scottish Section of the Plastics Institute, at More's Hotel, Glasgow. 7.30 p.m.

12th.—"Dough Moulding of Polyester Resins," by J. D. Davies. The South Wales and Monmouthshire Section of the Plastics Institute, at the Angel Hotel, Westgate Street, Cardiff. 6.30 p.m.

12th.—Discussion on "Relative Merits of Reinforced Plastics and Wood for Boat-building." The Southern Section of the Plastics Institute, at the Polygon Hotel, Southampton. 7.30 p.m.

12th.—"Printed Circuits on Plastics Panels," by F. Hicks-Arnold. The Yorkshire Section of the Plastics Institute, at St. Marks House, 186 Woodhouse Lane, Leeds.

New German Instruments

THE DECAMETER

Although the original classical works on the definition of ε and ε″ were published before the turn of the century, almost 40 years passed before instruments could be produced which permitted relatively accurate ε and ε″ measurement in workshop and laboratory. Only as a result of the rapid advances in electronics, following the last war, were dielectric constant and dielectric loss instruments able to establish themselves to an ever-increasing extent in various branches of industry and research laboratories.

The Wissenschaftlich - Technischen - Werkstätten of Dozent Dr. habil. Karl Slevogt, Weilheim, Upper Bavaria, have brought Decameters on to the market which are stated to incorporate many years of experience, particularly in the field of dielectric spectroscopy; they cover almost the entire frequency range up to microwaves. The different types of Decameters produced enable dielectric data to be determined to a degree of accuracy which will be found adequate even to the most exacting demands.

Just as one introduces the substance into a cuvette or trough for the purpose of optico-spectroscopic investigations, a suitable analyzer is used in this case also, but here it is a condenser. The shape of this condenser is determined by the type of equipment, measuring purpose and range of the substance handled and it can be adapted to optimum measuring accuracy, to permit sheets, foils, paper, solid materials, grains, powder, fibres, pastes, creams, liquids, and gases to be handled. The analyzers, which are normally produced from brass (nickel-plated), can also be supplied in glass, special steels or platinum for handling corrosive substances. Temperature range, which normally covers − 20 to + 160° C. can be extended to include very low temperatures or high ones up to + 1,000° C.

Applications of dielectric spectroscopy are extremely varied and include, above all, quantitative analysis. ε is a natural constant peculiar to a substance on the basis of its molecular structure. If the molecular characteristics of a substance change, its dielectric constants (ε) also change. Similarly, if substances with various values are mixed their ε value also changes. By applying the procedure in reverse one can therefore ascertain the extent of individual components from the value of a mixture. As a matter of interest it is also pointed out that moisture determination in almost all substances can be speedily and extremely accurately carried out with the aid of decametric analysis. They are of vital importance for production control purposes in almost every branch of industry. Since the result is produced immediately the possibility is afforded to take any action necessary during the manufacturing process.

The problems briefly referred to can be solved with the Decameter, type DK 03, a standard instrument which was developed for carrying out routine analyses. It can be operated by semi-skilled labour and has proved itself by performance under numerous conditions.

In addition to these standard types the Wissenschaftlich-Technischen Werkstätten are able to supply a number of Decameters with variable frequency ranges, which are equally suitable for the study of abnormal frequency and temperature dispersion or absorption in atom form research, for control purposes in the manufacture of high-grade plastics and insulating materials.

These instruments, particularly the types DK 08 onwards, in addition to permitting the measurement of ε and ε″, also permit magnetic characteristics, such as permeability and magnetic loss, to be determined. The Wissenschaftlich-Technischen-Werkstätten also devote their attention to the field of high-frequency and microwave spectroscopy, as well as nuclear resonance spectrometry.

A special apparatus has been developed by the same manufacturers to evaluate the electrical dipole moment of molecules; it is an extremely sensitive and accurate instrument and is marketed as the Dipolemeter, type DM 01.

Production men, research workers, chemists, physicists, doctors or engineers are thus provided with a range of equipment permitting investigations to be carried out on a much wider basis than was hitherto possible and entirely new fields are opened up.

POCKET MEGGER

THE new pocket megger, type MOM 2 T, brought on to the market by the same company that manufacture the Decameter, permits the taking of rapid and accurate resistance measurements independent of the lighting circuit. The instrument is furnished with a leather service case and, complete with battery, weighs only 1.5 kg. (3.3 lb.). Its dimensions are 100 × 110 × 200 mm. The metering range of the megger extends from 1 to 10^6 megohms and is divided into 10 subranges. The accuracy of the measurements amounts to ± 2 per cent.; it is ± 5 per cent. in the last two ranges of 10^{11} to 10^{12} ohms.

The current for the operation of the megger is delivered by built-in subminiature batteries similar to those used for hearing aids. In normal service of about 30 minutes daily, the batteries have a lifetime of approximately one year. It is shortened to around 100 hours with the instrument in uninterrupted use. The measuring voltage and/or the voltage drop may at any time be checked by means of a special control position of the metering-range switch.

The pocket megger operates on the principle of voltage division. With the help of optionally switched-in, specially selected standard resistors and the resistance of the test piece to be measured, the operator obtains a voltage divider with a measuring voltage of 22.5 volts. When the measurement is taken, a voltage drop enters in the switched-in standard resistor which is measured with a sensitive-tube voltometer with very high input impedance (subminiature electrometer tube). Indication is by means of an instrument directly calibrated in megohms.

The field of application for this handy device is extraordinary wide and extends from the laboratories of the modern plastics industry to the radio repair shop. It is used in the chemical industries for analyzing the high ohmic resistance values of glass-electrode chains, as well as for the determination of the electric conductivity of, for instance, hydrocarbons, or for testing plastics of all kinds for ohmic and insulation resistance values. For this purpose, special measuring electrodes are required, however, which may likewise be had from the same manufacturer. Furthermore, the device can be used for the finding of electrostatic charges, the measurement of influences of moisture, and for quality tests of prefabricated component of electrical equipment.

The widest scope of utilization is, however, offered to the pocket megger in electrical engineering where it renders good service in the testing of insulation resistance values of enamelled wires, cables, capacitors in transformers, etc.

The pocket megger type MOM 2 T.

American Report

Plastics Used in Solid Film Lubricants

By THOMAS A. DICKINSON

BY formulating plastics for use as solid film lubricants, a Los Angeles company has laid the foundation for what may well become an important new industry.

The company is Electrofilm, Inc., and most of its lubricants are made by dispersing particles of graphite, molybdenum disulphide, lead oxide, etc., in resinous binders. The dispersions are applied and dried like conventional organic coatings, after which their lubricating characteristics are such that they can:

(*a*) Separate two rubbing surfaces and thus eliminate galling and seizing.

(*b*) Minimize energy requirements by reducing the friction between moving parts.

(*c*) Prevent corrosion.

There is no reason to believe that such solid film lubricants can or will replace conventional media like greases and oils. But according to Ralph E. Crump, Electrofilm's chief engineer, they are finding many applications where:

(1) Parts or bearings to be lubricated are in inaccessible locations.

(2) Operating temperatures are extreme—that is, where loss of film strength at high temperature, or high coefficient of friction at low temperature, precludes using oil or grease. (Solid film lubricants are independent of temperatures between $-100°$ and $+600°$ F. Special films are available for temperatures above 1,000° F.)

(3) Systems are exposed to dust or other contaminants which impair operation. (Solid lubricants are dry and do not attract dust or lint.)

(4) Non-continuous operating systems make maintenance schedules expensive over long storage periods.

(5) Equipment is located in environments such as fuels, solvents, and liquid oxygen which are reactive to conventional lubricants.

(6) Bearings are likely to be overlooked during routine oil or grease lubrication.

Two current theories attempt to explain how solidified plastics with special fillers can lubricate. One points out that an absorbed layer (for example, of water where graphite is the filler; sulphur, where molybdenum disulphide is employed) may greatly reduce friction between moving parts. The other relates lubricational characteristics to the laminar-latticed crystal structures of the filler materials.

Substantiation for the latter theory can be found by examining the crystal structures of such fillers as molybdenum disulphide, wherein interatomic forces on each plane are so much greater than the forces between planes that there must be low shear strength and consequently a low coefficient of friction between planes. Even though they are in random orientation in a solid film, filler particles can be forced into alignment by rubbing two coated surfaces together—as evidenced by the increase of reflected light on an initially opaque coated surface.

Virtually all bonding agents have potentialities as solid film lubricants, but until recently the alkyds seemed to be most suitable for a majority of applications. At present, Electrofilm engineers prefer epoxy resins in their general-purpose formulations because experience has shown that these binders' inherent elastomeric properties plus ability to soften at elevated temperatures reduces the tendency of lubricating films and their deposition surfaces to separate when thermal expansion occurs.

Parts comprising such varied materials as unfilled phenolics, rubber, laminated glass fibres, ceramics, cork, and wood, have been satisfactorily lubricated with solid film materials. However, the latter are most commonly applied to metals at present.

In the deposition of plastic lubricants, parts with surface finishes of 32 to 62 micro-inches rms. are generally desirable because their irregularities facilitate chemical pretreatment and promote the adhesion of bonding media.

Chemical cleaning, degreasing, sand blasting, phosphating, anodizing, and other processes employed prior to the deposition of solid film lubricants are very similar to methods used in preparing different materials for the application of conventional organic finishes.

Spraying and dipping techniques are ordinarily used to deposit the lubricant dispersions, which may be solvent-thinned much the same as older coating materials. As a rule, spraying is done where film thicknesses must be maintained within precision limits; for, by controlling the solids content of a coating and the pressure with which it is applied, a worker can thus hold dimensional tolerances of ± 0.000010 in.

In any event, the film should be neither more than 0.0005 in. nor less than 0.0002 in. thick if it is to have good wear life.

Where dip-coating methods are employed, Electrofilm is able to avoid film irregularities and related difficulties due to "tear drops" by tumbling parts in a wire basket after they are dipped.

Because their basic constituents are usually thermosetting resins, applied films are generally cured at temperatures high enough to assure polymerization. Typical cure cycles at this writing involve the baking of films at 325° to 400° F. for one or two hours.

Coulomb, in 1871, first destinguished static and kinetic forms of friction. Since then, the causes of friction have been investigated with respect to atomic and molecular attraction, electrical field attraction, and the inter-locking of surface asperities. Consequently, it is now generally agreed that friction (F) is directly proportional to the shear strength (S) of the softer material and contact area (A) in any given system. Thus:

$$F = SA$$

It is further believed that the actual contact area (A) varies directly with the applied load (L) and inversely with the flow pressure of the softer material; and, since flow pressure is approximately equal to material hardness (H), we get:

$$A = L/H$$

A classical definition states that the coefficient of friction (μ) is the ratio of friction force and normal load, thus:

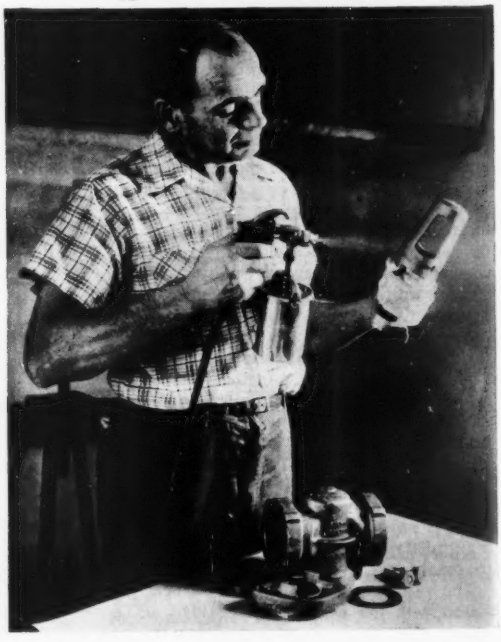
$$\mu = F/L$$

Therefore, by rearranging our second equation, we find that:

$$\mu = F/L = SA/HA = S/H$$

Because area is cancelled out, this shows that the coefficient of friction is dependent solely on the shear strength and the hardness of the softer material in a given friction system.

Where a solid lubricant is employed, the film provides a low shear value (about 2.4×10^3 p.s.i. at high loading); and, since it is apparent that the film itself has little structural



Plastic film lubricant is sprayed on to part of a valve.

strength, loads in the system must be borne by the elastic and plastic stresses of the materials to which the lubricant is applied.

A modified MacMillan test machine has been used to investigate the properties of solid film lubricants. It uses a friction head with strain gauges attached to a cantilever which deflects in proportion to a frictional force, and the strain gauges are coupled with a recording oscillograph which can be arranged to record friction force as a function of load, speed, motion, etc. Thus, where the friction force and the load applied to a test specimen is known, the coefficient of friction can be accurately calculated as indicated by accompanying curves.

In general, coefficient of friction values appear to be about 10% higher for oscillating motion than for rotating motion—probably because surface lubricating particles are re-oriented during each cycle of an oscillating mechanism, and remain constantly oriented in a undirectional mechanism. Other points worth noting are as follows:

(1) The coefficient of friction decreases with increasing load.

(2) The kinetic coefficient of friction will decrease slightly with an increase of velocity.

(3) Static values for the coefficient of friction are always higher than kinetic values. (No static values above 0.1 were noted in preparing accompanying data.)

(4) Two hard surfaces with a solid film lubricant in between is a superior arrangement, both frictionally and wear life-wise, despite accepted design practice for conventional lubrication.

(5) The rule of not using similar materials in plain and rubbing applications may be ignored in using solid film lubricants, since friction and wear life are evidently more concerned with material hardnesses than with similarities.

(6) If a choice must be made between processing the hard or the soft surface in a hard-soft bearing arrangement (i.e., steel against aluminium bronze), the softer metal should be processed.

(7) The changes in frictional coefficient with regard to temperature are small. Compared to the changes in frictional coefficient and viscosity in oils and greases, solid film lubricants are affected negligibly by a large change in temperature.

(8) The coefficient of friction for solid film lubricants will always decrease during the run-in. The steady-state values will be lowest for highest loads.

(9) In general the coefficient of friction is higher when both surfaces are coated (as compared to one surface only). It should be borne in mind, however, that wear life for both surfaces coated is considerably longer than for one.

(10) Generally it is better design practice to process the moving part rather than the stationary one, except when the "mover" is smaller (i.e., small piston in cylinder); then the larger area should be processed.

(11) Because the coefficient of friction increases with the softness of metals, solid film lubricants have made it practical to lubricate a system in which both members are hard.

The wear life of a solid film lubricant depends on many factors—including film thickness and composition, properties and pretreatment of deposition materials, various ambient conditions, and service requirements. However, films comprising 50% or more molybdenum disulphide are now considered to be the most durable solid lubricants.

Tests have shown that 1⅛ in. o.d. bearings coated with films of the latter type have an average wear life of 500,000 cycles under maximum unit loads of 80,000 p.s.i. at 72 r.p.m.; 400,000 cycles under the same loads where 20° oscillation is employed at the rate of 200 per minute.

Under less severe operating conditions, parts with dry film lubricants may of course have wear lives amounting to several million cycles.

Some of the more interesting applications for plastic lubricants are in mechanisms designed for use in manmade earth satellites. Neither gaseous nor fluid lubricants could serve the same purposes, because they could not be retained where they would be useful in outer space.

In the manufacture of many types of food processing machinery, dry film lubricants are equally indispensable—since they represent the only feasible method of minimizing friction without contaminating food products.

Like other coating materials, plastic lubricants cannot actually eliminate corrosion; but they can delay the start of it for periods that may exceed the life of a part. For example, tests have shown they can retard the beginning of fretting corrosion (steel ball against glass flat) as many as 28,000,000 cycles.

In a number of instances where oils and greases were once used, dry film lubricants are now employed simply because they cannot drip or be rubbed off and will consequently enhance the saleability of certain products.

Similar, but more practical, considerations indicate the use of the new lubricants in chemical industries; for, due to the inertness of various resinous binders, it is practical to formulate coating films with extreme resistance to virtually all fluids now being processed.

Ability to prevent galling and seizing of the mating surfaces of parts comprising such troublesome materials as aluminium and titanium is outstanding among factors that have dictated the widespread use of solid film lubricants in aircraft and missiles.

COEFFICIENT OF FRICTION DATA FOR GENERAL-PURPOSE PLASTIC LUBRICANT

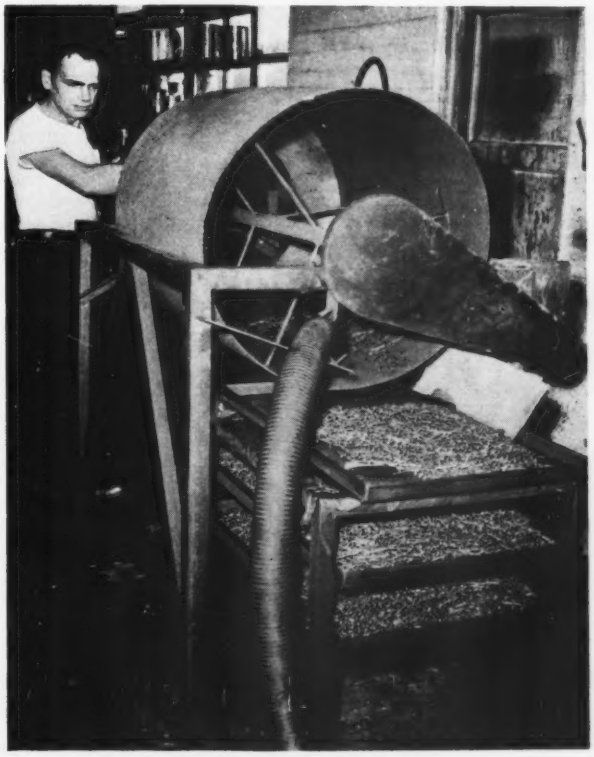
Rotating Metal Specimen, Coated	Load Block, Uncoated	Coefficient of Friction*
52100 C. H. Steel	4130 C. H. Steel	.023 kinetic
" " " "	75ST Aluminium	.04 kinetic
303 Stainless Steel	4130 C. H. Steel	.032 kinetic
140A Titanium	" " " "	.035 kinetic
Aluminium Bronze	" " " "	.035 kinetic
" "	75ST Aluminium	.032 kinetic
Chrome Plate	4130 C. H. Steel	.033 kinetic
" "	75ST Aluminium	.042 kinetic
Nickel Plate	4130 C. H. Steel	.033 kinetic
" "	75ST Aluminium	.034 kinetic
7075–T6 Aluminium	4130 C. H. Steel	.035 kinetic
52100 C. H. Steel	" " " "	.072 static
" " " "	" " " "	.087 kinetic

*Note: All kinetic values at about 26 ft. per min.

COMPARISON DATA

Materials	Condition	Coefficient of Friction
Steel on steel	Dry	0.45–0.60
Brass on steel	"	0.44
Babbit on mild steel	"	0.33
Glass on glass	"	0.4
Steel on steel	E. P. Oiled*	0.042
Lubrite on steel	S.A.E. 10 Oiled*	.082
Lubrite on steel	Dry	.168

*Boundary lubrication.



Parts that have been dip-coated in plastic lubricants are tumbled in a rotating basket in order to obtain films of uniform thickness.

Book Reviews

Polyamide Resins
By D. E. Floyd. 230 *pp.*
Reinhold, distributed by Chapman & Hall.
Price 36*s.*

This is one of the Reinhold Plastics Applications series and the emphasis, as the series title suggests, is intended to be on applications. The general introduction outlines the potential readership, to include design engineers, equipment manufacturers, producers of packages, etc. It is curious therefore that this volume leaves itself open to criticism in that if it is intended for potential users of plastics materials, it does not stress nearly strongly enough, the applications aspects. In 230 pages there are less than 30 photographs showing polyamides in use. Again, the book commences with a chapter on the general properties of polyamide resins, which contains such phrases as " the 6,6 type, of course, is manufactured from hexamethylenediamine and sebacic acid." This potentially indigestible statement is followed in the next chapter by a review of the basic chemistry of polyamides and we suggest that the order might have been reversed.

The chapter on manufacturing processes for polyamide resins is very short.

The author then goes on to deal with coatings and films, fibres, mouldings, castings, extrusions, adhesives, and several applications such as the use of polyamides as water dispersions, organasols, inks, etc. In these chapters a reasonable picture is given of the use of polyamide resins. It is difficult to escape the conclusion, however, that in this volume the potential readership has not been defined precisely.

Cellulosics
By W. D. Paist. 270 *pp.*
Reinhold, distributed by Chapman & Hall.
Price 46*s.*

In this volume, also in the Reinhold Applications Series, the order of presentation is admirable. After a lucid introductory chapter, the author deals briefly with the chemistry of cellulosics. He then describes the properties of this family of plastics, in terms which will interest the potential user. The chapter on fabrication is equally practical. The succeeding discussions on applications are very well written, and very informative. Here again, however, as a book primarily intended to deal with applications, it has the deficiency in illustration; only two photographs of cellulose materials in use are given. This obviously detracts from an otherwise well written and well thought-out volume.

Polyethylene
By T. O. J. Kresser. 217 *pp.*
Reinhold, distributed by Chapman & Hall.
Price 40*s.*

This is volume 1 in the Applications Series launched recently by Reinhold. It is also one of the best of the series, presenting the facts in a logical manner, and with a sufficiency of illustrations to convey to the reader who is close to the polythene field a visual impression of the way polythenes are made and the uses to which they can be put. As a pocket compendium of information on this important group of materials, it can be heartily recommended.

Plastic Sheet Forming
By R. L. Butzko. 181 *pp.*
Reinhold, distributed by Chapman & Hall.
Price 36*s.*

Sheet forming with cellulose acetate was one of the first major techniques of the plastics industry; with the newer materials, polystyrene, p.v.c., and polythene, the technology has enjoyed a renaissance, and Mr. Butzko's book provides a valuable summary of the situation today in the vacuum forming field. It also includes useful chapters on ancillary equipment, on cutters, and notes on printing, and concludes with an interesting discussion on production costs. This is a practical handbook, and all concerned with vacuum forming will want to have a copy.

Catalysis in Practice
C. H. Collier. 150 *pp.*
Reinhold, distributed by Chapman & Hall.
Price 32*s.*

Edited by C. H. Collier, this volume comprises a collection of seven papers originally presented under the auspices of the American Institute of Chemical Engineers and the University of Pennsylvania.

Current Trends in Heterocyclic Chemistry
Edited by A. Albert, C. M. Badger and C. W. Shoppee. 170 *pp.*
Butterworths Scientific Publications.
Price 30*s.*

This volume constitutes the proceedings of a symposium at the Australian National University, Canberra, in 1957. Although primarily of interest to the medical and biochemical worlds, there is a quantity of information in this book of interest to the polymer chemist and physicist. Heterocyclic chemistry, although constituting some one-third of the organic chemistry field, is by far the least explored, and the Canberra Symposium served a valuable purpose in concentrating attention on some of the interesting aspects of this branch of organic chemistry which will repay further study.

Electric Furnaces
Edited by C. A. Otto. 248 *pp.*
George Newnes Ltd.
Price 35*s.*

Designed to show how the main types of electric furnace are used in industry, the book contains 14 contributions by specialist authors. Whilst mainly concerned with furnaces, there are two chapters of special interest to readers of this paper. Mr. G. T. Collins, chief electrical engineer of British Industrial Plastics Ltd., has written an interesting chapter on electric heat in the plastics industry and Mr. C. Walter has contributed a section on control and measurement equipment.

Extrusion of Plastics
By E. G. Fisher. 114 *pp.*
Iliffe & Sons, Ltd., for the Plastics Institute.
Price 21*s.*

Mr. Fisher has long been known as an authority on extrusion. This monograph offers a comprehensive survey of the process, dealing fully with basic principles, single and multi-screw machines, and materials for extrusion. It is well illustrated with line diagrams and is logically compiled. It will be particularly useful to advanced students of plastics technology.

Concise Guide to Plastics
By H. R. Simonds. 318 *pp.*
Reinhold, distributed by Chapman & Hall.
Price 56*s.*

The word " guide " can be very misleading; Mr. Simonds employs it in the best sense of the word, for although it is patently impossible to cover the field of plastics adequately in 318 pages, he does signpost the way and the lay reader will find this book of considerable value. The decision to include prices of materials may be criticized, in view of their necessary obsolescence in many cases, but even this may be justified on the grounds that at least some comparison is possible. The slant is heavily American, and much of the data published is relevant only to the American reader, but the book is nevertheless a useful compilation.

Inorganic Fibres
By C. Z. Carroll-Porczynski. 353 *pp.*
National Trade Press Ltd.
Price 57*s.* 6*d.*

The author has given a wide interpretation to his title, as a result of which this book is of considerably greater interest than the title above suggests. It covers in excellent detail the manufacture, properties and finishing of glass fibres and textiles, deals equally well with asbestos, and contains some good chapters on reinforced plastics. The author can be commended for using the published literature—his bibliographical references are comprehensive. Anyone concerned with reinforced plastics will find this work a valuable addition to the bookshelf.

Phenolic Resin Chemistry
By N. J. L. Megson. 323 *pp.*
Butterworth Scientific Publications.
Price 65*s.*

Dr. Megson is fortunate that very early in his career he became known as having a special interest in phenolic resin chemistry; his international fame has resulted in his being the recipient of original papers from most other workers in this field. The result is a work of major importance, a critical account of the important papers published since 1939. As might be expected of both author and publisher, the volume is meticulously presented. The detailed bibliographies following each chapter further enhance the scholarly commentary.

The work is in 10 chapters, the first outlining briefly the field to be covered. Dr. Megson then provides a systematic historical survey, followed by detailed chapters as follows: heating of phenol alcohols; special reactions of phenols, phenolic alcohols, and related compounds; ammoniacal and related phenol-formaldehyde condensations; rational syntheses; rates of reaction and kinetic studies; fine structure of resins; fractionation of resins and the use of chromatographical methods; general investigations.

By ignoring the technological aspects, Dr. Megson has made it possible to cover an enormous amount of ground in the pure chemical field. " Phenolic Resin Chemistry " will take its place in literature as a major work.

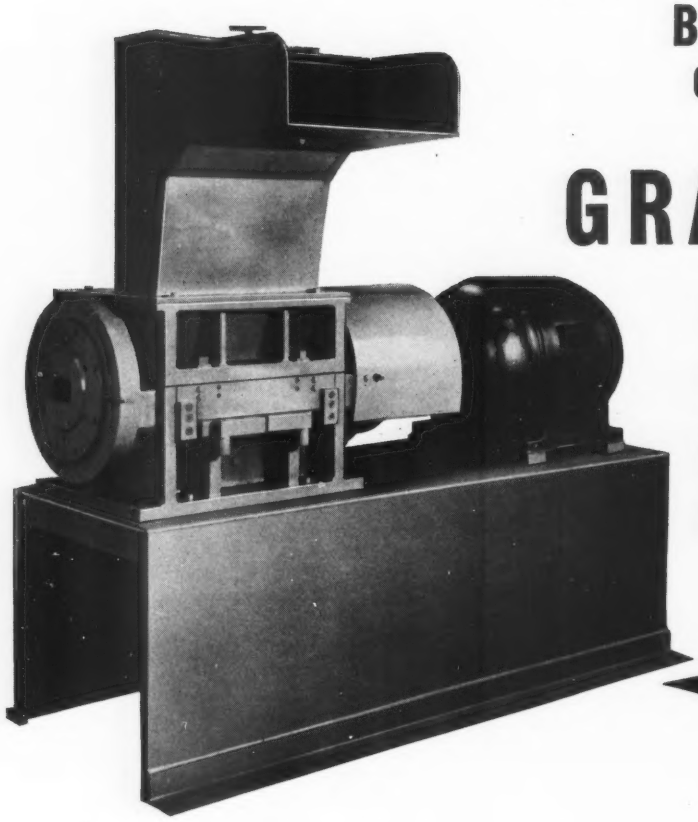
LEAVE IT AT LORIVAL

For long-running mass-production plastic mouldings in any material it certainly pays to 'leave it to Lorival'

LORIVAL PLASTICS · UNITED EBONITE & LORIVAL LTD · LITTLE LEVER · NR BOLTON · LANCS

BURTONWOOD
CUMBERLAND
MODEL 20
GRANULATOR

PELLETIZERS
DICERS
CHOPPERS AND
PRE-BREAKERS



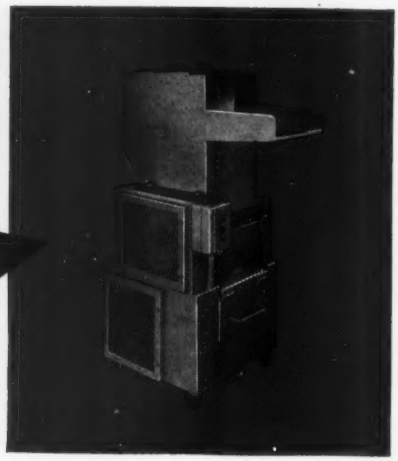
LARGE THROAT OPENINGS— 9″ × 20″
12¾″ × 20″

SUPERB CONSTRUCTION—heavy steel fabrication with deep welds. Rotor and seal rings are heat treated to provide tough undamageable parts, and ground all over to achieve extreme dimensional accuracy and balance.

VERSATILITY—handles "chunky" pieces of toughest plastic materials such as extruder spewing, cylinder purgings and heavy slabs of thermoplastic materials. Special adaptors for handling long lengths of pipe such as kralastic, high impact vinyl and polyethylene.

Model O for use in conjunction with injection moulding and extrusion machines. Mobile, bench, or floor mounting types available.

BESIDE THE PRESS GRANULATOR



Beside the Press Granulator. Entirely new model, throat size 12″ × 16″.

BURTONWOOD ENGINEERING COMPANY LIMITED

Burtonwood, Warrington, Lancashire. Telephone: Newton-le-Willows 3311 (10 lines)
Warbrick (Engineering) Specialties Ltd., Barclays Bank Chambers, Sankey Street, Warrington. Tel.: Warrington 4081.

Nottingham Conference on High Polymer Technology—Part 2

The proceedings are reported for "Plastics" by J. Glazer, Ph.D., and N. H. Langton,* M.Sc., Ph.D., A.Inst.P. The concluding part will be published in the November issue.*

Electron Spin Resonance Studies of Radicals Trapped in Polymers

N. M. Atherton, Sir Harry Melville, and D. H. Whiffen, The Chemistry Department, The University, Birmingham, England

The use of electron spin resonance techniques for the study of free radical polymerizations enables the radicals to be investigated directly as long as the radical concentration is high enough. A sufficiently high radical concentration can be obtained by the addition of a difunctional monomer so that the system becomes crosslinked to a three dimensional network. This paper describes the investigations of mixtures of methyl methacrylate and glycol dimethacrylate. The electron resonance spectrometer operated at 9,200 mc./s with a magnetic field of 3,300 gauss. With the operating conditions used, the area under the absorption curve was a function of the number of radicals present, so that the instrument could be calibrated against 100% organic free radicals.

Results are given of an investigation into the polymerization of MMA and GDMA, the polymerization being initiated by the decomposition of ABIN when irradiated with ultraviolet light of 3,650 Å. The curve showing the variation of concentration of trapped radicals with reaction time exhibited a maximum after about 3 hours. A further study of this maximum showed that there was a termination reaction which competed with the trapping process.

The authors next discuss the identification of radicals by electron spin resonance, and give diagrams of the types of spectra obtained.

The results described in this paper can be used to give a qualitative picture of the radical trapping process. The authors conclude that with improvements in the sensitivity of the electron spin resonance method and in the trapping techniques, this method of investigation should provide information which cannot be obtained by the more usual methods of investigation.

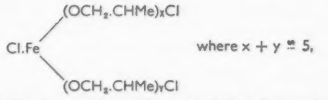
The Polymerization of Epoxides by Metal Halide Catalysts

R. O. Colclough, G. Gee, W. C. E. Higginson, J. B. Jackson, and M. Litt, The University, Manchester

This paper was described as a progress report of an investigation into the polymerization, at 80° C., of certain epoxides by Lewis acids in general and ferric chloride in particular. Among the metal halides found effective as polymerization catalysts were $AlCl_3$, $SbCl_5$, $BeCl_2$, BCl_3, $FeCl_3$, $InCl_3$, $SnCl_4$, $TiCl_4$, $ZnCl_2$ and $ZrCl_4$. The epoxides of ethylene, propylene and styrene were investigated.

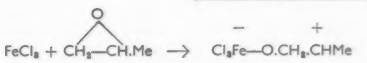
Under suitable conditions, crystalline (m.p. *ca* 60° C.) polyethylene oxides were produced of M. Wt. 10,000 (estimated). Styrene oxide gave viscous liquid products of comparatively low M. Wt., together with a crystalline dimer. Propylene oxide was found to polymerize to a mixture of liquid, amorphous solid and polycrystalline products. In this system, the authors observed that a small amount of moisture was necessary for the production of crystalline polymer and this was confirmed in subsequent experiments.

A previous observation that the $FeCl_3$-catalyzed polymerization of propylene oxide occurred in two distinct stages led the present authors to investigate the product formed after the initial reaction stage only had been completed. They suggested that the low M. Wt. product initially obtained was of the following type:

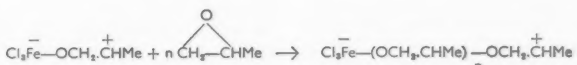


and that it was formed by the following cationic mechanism in which the first chlorine of $FeCl_3$ was replaced by a short polymer chain, thus:

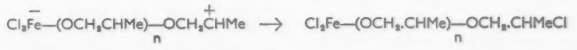
initiation



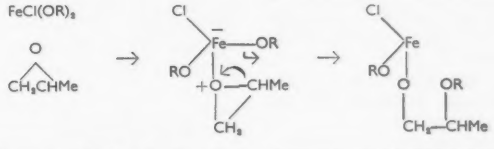
propagation



termination



after which the same sequence was repeated, this time with the second chlorine. They further suggested that the above-mentioned initial product (now written as $FeCl[OR]_2$) provided a locus for the second, slower stage during which high M. Wt. polymers were built up, and they suggested the following mechanism:



Since this product remained of the type $FeCl(OR)_2$, it could undergo further monomer addition reactions and thus give rise to high polymers. Furthermore, since the monomer always added on in the immediate neighbourhood of the Fe group, it was not difficult to allow that steric conditions could give rise to stereospecific effects. The role of water in determining specificity was not yet clear but it seemed not improbable that its presence imposed more stringent steric restrictions in the region of the Fe group—possibly, for example, as $FeOH(OR)_2$.

* Senior Lecturers, National College of Rubber Technology.

Trapped Radicals in Heterogeneous Vinyl Polymerization

C. H. Bamford, A. D. Jenkins, M. C. R. Symons and M. G. Townsend, Courtaulds Ltd., Research Laboratory, Maidenhead, Berks, and Chemistry Department, University of Southampton

The object of this paper was to describe the results of measurements of the concentration of trapped radicals in acrylonitrile which had been bulk polymerized. By the term "trapped radicals" is meant the occlusion of free radicals by polymer chains. The mean degree of occlusion refers to the magnitude of polymer barrier formed round the radical. This barrier protects the radical from chemical reagent molecules, and in some cases the degree of occlusion is so high that they may survive for an indefinitely long period of time. The proportion of radicals that become trapped during a polymerization is taken to be indicative of the mean degree of occlusion. The fact that such trapped radicals exist was deduced from kinetic considerations, and their existence confirmed by the use of electron-spin resonance. It is now possible, by means of the latter technique, to obtain fairly accurate estimations of the trapped radical concentrations.

The authors describe their results obtained from the electron resonance spectroscopy of the acrylonitrile. The concentration of trapped radicals was measured as a function of certain experimental variables. The effects of swelling agents upon the concentration was investigated. It would be expected that the concentration would decrease with the addition of a swelling agent. Contrary to expectations, it was found that there was an initial increase in the trapped radical concentration with the addition of swelling agent until about 8 mole-%, after which the number decreased as expected.

The authors next consider the effect of copolymerization of the acrylonitrile with methyl acrylate, methyl methacrylate and vinylidene chloride. Next is considered the effect of varying the light intensity during the photopolymerization. The fraction of trapped radicals produced increases by a factor of just over two for an increase of illumination intensity of 13 times, so that increasing the intensity has little effect.

Experiments during which the rate of reaction remained constant whilst the temperature was increased showed that the trapped radical concentration decreased as the temperature of photopolymerization was increased. The final experiments described are when oxygen was admitted to the radicals at room temperature. This causes a decay in the radical concentration with time, apparently caused by the oxygen diffusing into the polymer chains.

The last section of the paper is a short and tentative discussion of the structure of the trapped radicals.

The Polymerization of Acrylonitrile in Aqueous Solution

F. S. Dainton and (in part) P. H. Seaman, D. G. L. James and R. S. Eaton, Leeds University

The purpose of this paper was to rationalize some of the previously reported kinetic results on the polymerization of acrylonitrile in aqueous solution. All materials were scrupulously purified and both chemical ($Fe^{2+} + H_2O_2$) and photochemical (Fe^{2+}/U.V. and Fe^{3+}) initiation were used for this dilatometric investigation.

The reaction curve contained an initial, short, accelerating region followed by a linear, constant rate region after which the reaction gradually terminated over a region of slowly decreasing rate. With photochemical initiation, the initial accelerating region was more prolonged and this was shown to result from an increase in the U.V. absorption capacity of the system during the early stages of polymer insolubilization.

Although the detailed mechanism of the reaction remained unknown, it was now believed that some of the previously reported contradictions could be explained by the existence of two distinct polymer growth processes. One corresponded to the rapid addition of soluble monomer to a single growing polyacrylonitrile radical. The other process corresponded to the slow addition of monomer at a growing polymer chain situated in colloidally dispersed polymer particles. Whereas the former process was terminated by mutual radical collision or by Fe^{3+} oxidation, the latter process could only terminate by the much more infrequent collision between particles of colloidal size.

Heterophase Radiation Polymerization of Isobutene and Methyl Methacrylate

R. Worrall and S. H. Pinner, Tube Investments Research Laboratories, Saffron Walden

The work described in this contribution was undertaken in order to counteract the tendency of regarding all radiation induced polymerizations as proceeding via free radical mechanisms.

The system chosen for investigation was the low temperature polymerization of isobutylene, induced by (Co^{60}) γ-radiation and fast (van de Graaff) electrons. This particular monomer was chosen because of its susceptibility to polymerize, at low temperatures, by an exclusively ionic mechanism when the reaction is initiated chemically. Results were presented which showed that the above system, on irradiation, did indeed polymerize to give high M. Wt. rubbery polymers indistinguishable from those obtained by chemical initiation.

The likelihood of this process being ionic in nature was increased by the authors' demonstration that the presence of metal oxide powders resulted in a large increase in polymerization rate. Such powders (ZnO, CaO, MgO, SiO_2) were known to be completely inert with respect to free radical polymerization, whereas the catalytic effect of crystalline solids in ionic polymerization is not without precedent. It was believed that metal oxides catalyzed the radiation-induced polymerization by increasing the rate of initiation.

In similar experiments on the (free radical) electron-induced polymerization of methyl methacrylate at room temperature, it was shown that the presence of polyethylene increased the polymerization rate, but this was ascribed to a decrease in the rate of termination.

Some Observations on the Effect of the Physical Nature of the Separating Phase on the Rate of Heterogeneous Polymerization

Santi R. Palit and Tilak Guha, Indian Association for the Cultivation of Science, Jadavpur, Calcutta, India

The authors describe experiments on the aqueous polymerization of water soluble monomers, such as acrylonitrile, and methyl methacrylate, where there is a separation of phases because the polymer formed is insoluble. They have observed that the rate of polymerization shows an unexpected decrease after the initial increase. This rate dependence is connected with the stability of the colloid which is produced by the polymer as it separates out. A higher rate corresponds to a more dispersed and stable colloid.

The preparation of the samples is described in detail. Potassium persulphate and sodium hyposulphite were used as initiators, and the polymerization carried out in an atmosphere of oxygen free nitrogen. The results are given in the form of graphs and tables, exhibiting the percentage yield with time and the physical state of the polymer produced. By increasing the initiator concentration it was possible for the authors to increase the coarseness of the colloidal polymer until it became a coagulum. The polymerization rate was shown to fall conspicuously as the nature of the separating phase changed from a stable sol to a coarse coagulum. If the initiator concentration is further increased, the curve of variation of polymer yield against time tends to become "S" shaped. This leads to a yield versus activator concentration curve which shows a maximum followed by a minimum.

These initial experiments were followed by similar experiments where a salt was added as a coagulant. The addition of sodium sulphate, for example, decreased the rate of polymerization. On the contrary, when a peptizer or stabilizer was added to ensure greater stability of the separating colloidal polymer, an increase of rate was observed. Thus the correlation between the rate of polymerization and the physical state of the separating polymer was confirmed.

These experiments show that the rate of heterogeneous polymerization is intimately related to the stability of the colloidal polymer so formed, as long as the rate of yield is below that for "explosive" polymerization.

Heterogeneous Copolymerization of Methylmethacrylate Esters with the Methacrylate Ion in Aqueous Media

R. J. Parsons and H. Warson, Vinyl Products Ltd., Carshalton, Surrey

This paper describes an investigation into the copolymerization of methyl methacrylate, which is slightly water soluble, with sodium methacrylate, dispersed as an aqueous emulsion. The methyl methacrylate was maintained in a fine particle size by rapid stirring and the use of a water soluble colloid. A mixture of the two monomers was prepared in the desired molar ratio, and the mix polymerized using a persulphate initiator. It was found that, provided that the conditions were the same each time, the results were reproducible. The course of the polymerization was followed by specially worked out analytical methods for detecting each monomer in the presence of the other. The results of a number of experiments are given, and there is a discussion of the kinetics of the polymerization reaction.

The Kinetics of Block and Graft Copolymerization of Acrylonitrile

C. H. Bamford, A. D. Jenkins and E. F. T. White, Courtaulds Ltd., Research Laboratory, Maidenhead, Berks.

In this paper the authors consider the kinetics of block and graft copolymerization of a monomer in the presence of a preformed polymer. Particular reference is made to the case when the second monomer is acrylonitrile.

Experiments were carried out in dilatometers immersed in thermostats at 60° C., and the molecular weights were measured viscometrically.

Results are given when polysarcosine was used as a transfer agent, and with polymethyl methacrylate as an additive. A mechanism of solubilization is suggested, and the experimental results are shown to be in accord with this.

Synthesis of Graft Copolymers

G. Smets, A. Poot, M. Mullier and J. P. Bex, Laboratory of Macromolecular Chemistry, University of Louvain, Belgium

The authors consider the kinetics of the graft synthesis of copolymers. Several methods of two-stage synthesis were used, involving the initiation of the polymerization of styrene with polymethyl acrylate copolymers containing tert-butyl perester groups. A new method of synthesis of block copolymers based upon the decomposition of tert-butyl hydroperoxide is also presented.

The first part of the paper deals with the graft polymerization with tert-butyl perester side groups, and numerous graphs and tables give details of the experimental results.

Next is a section about block polymerization with tert-butyl peroxide end groups, followed by a discussion of graft polymerization with side hydroperoxide groups. The final section of this paper is a detailed description of the experimental procedure used by the authors.

Grafting Polycaprolactam on a Polymethacrylate-type Backbone

O. Wichterle and V. Gregor, Technical University, Prague, Czechoslovakia

This paper describes an investigation into the mechanism of the polymerization of ε-caprolactam by alkaline catalysts in the presence of diacylamines.

The grafted copolymers produced have a characteristic three-dimensional structure, which shows that branching on the side chains takes place in the course of grafting and cross links are formed between the original backbone chains. The investigation of this cross-linking reaction offers a sensitive method for the investigation of branching of polyamide chains.

The Preparation and Properties of Grafts of Polycaprolactam on Vinyl Copolymers

C. B. Chapman and L. Valentine, The Department of Textile Industries, The University, Leeds

This paper describes the results of experiments in which Lactam and vinyl copolymer in the required proportions were heated in a sealed tube for about 24 hours at a temperature of about 190° C. With water as an initiator, polymerization took place. The resulting polymers were then investigated and analyzed. Vinyl copolymers were also produced by heating mixtures in tubes at 60° C. with no diluents so that a 5% to 10% conversion was obtained.

It was concluded that although graft polymers could be made in this manner, pure products could only be obtained by exercising careful control in order to avoid cross-linking and ester exchange reactions.

Influence of Bond Angle Restrictions on Polymer Elasticity

P. J. Flory, C. A. J. Hoeve and A. Ciferri, Mellon Institute, Pittsburgh, Pennsylvania

Theories of rubber elasticity are usually based upon an idealized model of a molecular chain whose units can rotate about bonds without causing any alteration in the internal energy of the chain. Flory began his paper by mentioning that work with dilute solutions of linear polymers has indicated that there are changes in the mean dimensions of the molecular chain with temperature. When this is the case, the internal energy E will change with deformation at constant volume and temperature. If $\overline{r_0^2}$ represents the mean square end-to-end distance of the chain in the uperturbed state, then E depends upon r_0. This paper describes an investigation into the relationships between the temperature coefficient of $\overline{r_0^2}$ and the elastic equation of state of the network.

Commencing with the configuration integral Z_f of the chain, Flory discusses the difficulty of obtaining a convenient expression for this quantity. He concludes that a Gaussian distribution may be assumed for the probability distribution function $W_0(r)$, which is valid irrespective of the nature of the interactions, as long as they are confined to near neighbour chains, and that the chains are sufficiently long. Flory then obtains an approximation for the conformational free energy of the polymer chain, followed by an expression for the elastic free energy of a network. He then considers the elastic equation of state and the internal energy component, assuming that the change in internal energy with deformation is intramolecular only, and that the intermolecular energy is effectively independent of deformation at constant volume.

Some experimental results are considered in the light of the theory, and it is concluded that the " stress-temperature measurements afford a powerful tool for the elucidation of the conformational behaviour of polymer chains, and specifically for the evaluation of the mutually related changes of $\overline{r_0^2}$ with temperature and of the internal energy of the chain (or network) with deformation." An important point in this paper is the examination made of the effects of deviations in the statistical distribution of $\overline{r_0^2}$ from the Gaussian model.

Intermolecular Forces and Chain Flexibility in Linear Polymers

G. Allen, G. Gee, H. A. Lanceley, D. Mangaraj, Manchester University

This paper described some recent results obtained by the authors using their novel method for estimating the magnitude of the intermolecular cohesive forces and chain flexibility of a comparatively low M. Wt. (D.P. = 8) sample of liquid polyisobutylene.

By regarding viscous flow as an activated process in which the polymer must be energized by E_p (for flow at constant pressure conditions) or by E_v (at constant volume), it was shown that $E_p = E_v + P_i.\Delta V$, where P_i was the internal liquid pressure of the polymer and ΔV was the activation volume of the flow process. The latter quantity could be regarded as the expansion undergone by a molecule before it could move.

Values for P_i were obtained from measurements of the temperature coefficient of pressure, values for E_p were obtained from the temperature coefficient of viscosity and values of ΔV were obtained from the pressure coefficient of viscosity. By substituting the values obtained with liquid polyisobutylene in the above equation, values for E_v were obtained.

By considering the magnitude of the ratio $\Delta V/V$ (where V = molar volume) as characterizing the stiffness of the molecule, the authors showed that, below room temperature, liquid P.I.B. appeared to move as a rigid molecule during viscous flow. At higher temperatures, this ratio decreased considerably and this was interpreted as resulting from a marked increase in molecular flexibility thereby allowing polymer flow properties to be determined by segmental movement rather than molecular movement.

During the presentation of this paper, the authors reported an extension of P_i values to include polystyrene, natural rubber, polyisobutylene and a silicone. The magnitude of the P_i values decreased in that order and demonstrated a method of relating the magnitude of intermolecular forces to chemical structure.

An Internal Friction Study of Polytetrafluoroethylene

N. G. McCrum, Polychemicals Department, E. I. Du Pont de Nemours & Co., Du Pont Experimental Station, Wilmington, Delaware

The author describes, in this paper, a study of the internal friction in polytetrafluoroethylene over a temperature range of from 4.2° K. to the crystalline melting point of 600° K. For most of the work, a torsion pendulum was used, as a dynamic method enables the kinetic nature of the relaxation effects, which occur at certain temperatures, to be best studied. Both the modulus and the logarithmic decrement were measured in the usual way, and the construction of the pendulum and ancillary apparatus is described in detail in the paper.

Sample strips of Teflon of varying but known percentages of crystallinity were used, and results are given for samples of 92%, 76%, 64% and 48% crystalline. The internal friction is obtained from the logarithmic decrement, and graphs are given showing the variation of this quantity, and the torsion modulus, with temperature. It is seen from these that the internal friction has several maximum values for temperatures above 160° K., whilst the torsion modulus value decreases continuously as the temperature rises.

After the description of the experimental procedure and results, the author gives a detailed discussion of the transitions which occur at 176° K., 300° K., 400° K. and the large relaxation which occurs at the crystal melting point. This portion of the paper contains a large amount of interesting information which it is impossible to summarize, except to say that the author shows that amorphous regions exist in three phases between 4.2° K. and the crystalline melting point.

On Certain Trends in the Synthesis and Practical Application of Graft Copolymers

A. A. Berlin, Laboratory of High Molecular Weight Compounds, Moscow

This paper starts with a discussion of the synthesis of graft copolymers of branched structure, and describes studies of the polymerization of a number of monomers in the latices of polyvinyl chloride and synthetic rubbers. Results are given for the polymerization of vinyl chloride in the latex of the copolymer of butyl methacrylate. The principal characteristics of the resulting graft copolymer for varying ratios of the constituents are then discussed, with particular emphasis on the thermo-mechanical properties.

Results are then given of the graft or mechano-chemical copolymerization of a number of monomers with synthetic rubbers (butadiene-styrene and butadiene-acrylonitrile rubbers).

Finally, the author discusses the synthesis of graft copolymers of three-dimensional structure.

Sur le Greffage du Polymethacrylate de Methyle sur le Caoutchouc d'Hevea

W. Kobryner and A. Banderet, Centre de Recherches sur les Macromolecules, Strasbourg, France

To investigate the graft polymerization of methyl methacrylate and hevea rubber in the presence of a suitable catalyst, it is necessary to be able to separate the three constituents of the reaction. The authors have developed a method for doing this based upon the facts that the free P.M.M. alone is soluble in acetone, whilst the graft polymer formed is swollen and the free rubber is insoluble. The first part of this paper describes in detail this method of separation.

The results of the grafting experiments are then discussed, followed by a consideration of industrial graft polymers.

The paper ends with a discussion of the variations in structure of the polymers and of the mechanism of the grafting.

(to be continued)

The Electron Microscopy of High Polymers

By N. H. LANGTON,* Ph.D., A.M.Brit.I.R.E., A.Inst.P.
and MARGOT STEPHENS,* A.I.S.T., L. de Ph. (Lille)

THERE are, at the moment, about 100 electron microscopes in industrial or research organizations in this country. The electron microscope is being used increasingly for the investigation of problems directly or indirectly concerned with the high polymer industry, both for the microscopical examination of the polymers themselves, or for examining fillers and other materials used in production processes. The object of this article is to describe the principles of electron microscopic examination of such materials, so that the high polymer technologist may gain some idea of the scope of application of this method of investigation and of the difficulties in the method which are peculiar to high polymers. At the National College of Rubber Technology, a Philips electron microscope has now been in use for over three years, and the work has been directed entirely to the investigation of problems in rubber and plastics technology, so that a considerable body of experience has been built up in these fields. There are no set rules that can be laid down for the examination of high polymer materials, and success depends mainly upon the experience of the electron microscopist. It is hoped, therefore, that what follows may be of some interest to those engaged in the industry who are contemplating the use of the electron microscope for the investigation of problems in the high polymer field.

The Principles of Electron Microscopy

The ordinary optical microscope cannot be made to magnify indefinitely, nor can its magnification be increased very much by photographing the field of view and enlarging the photograph. The upper limit to the magnification is inherent in the nature of the process, and is not a limitation due to optical engineering difficulties. For this reason the development of the optical microscope has more or less come to an end, because it is now as perfect as it is possible to make it. The upper limit of magnification is about 1,500 diameters using visible light, whilst a magnification of about 3,000 diameters can be obtained with ultra-violet light. It is necessary to appreciate the reasons for these limits in order to understand the operation of the electron microscope.

When we look at an object in visible light, we see it because its presence alters the pattern of light which would otherwise have reached our eyes had the object been absent. To a first approximation, visible light energy travels in straight lines. More accurately, however, light rays bend very slightly around the edges of an illuminated object, a phenomena known as diffraction. For any object large enough to be seen by the unaided eye under normal circumstances, this diffraction round the edges of the object is far too small to be detected, so that we see the edges in sharp focus and are not conscious of any lack of definition here. If the object we are viewing is very small, however, so that we have to look at it through a microscope, the amount of diffracted light energy becomes an appreciable proportion of the total light energy reaching the eye. Under high magnifications, the diffraction effect at the edges of the viewed object becomes very noticeable, and the edges of the object, or of internal structures, appear to be blurred. When this stage is reached, further magnification is pointless, as it only increases the lack of definition. Therefore we have an upper limit to the degree of magnification possible. It can be shown that the important factor in this phenomena is not the absolute size of the object to be magnified, but its size relative to the length of the illuminating radiation. In fact, if d is the smallest diameter of the object, λ the wavelength of the incident light, and N the numerical aperture of the microscope, then it was shown by Rayleigh that

$$d = \frac{\lambda}{2N}$$

where d is the smallest object dimension that can be seen before the diffraction effect becomes significant. The quantity N is a constant for any particular microscope, and depends also upon the medium through which the light rays pass. The quantity d then gives the size of the smallest object that can be seen clearly in a given microscope. For a microscope used in air, N is slightly less than unity, whilst the best that can be done is to use oil immersion objectives, which give N=1.5. Consequently the optimum conditions for a microscope are expressed by the equation,

$$d = \frac{\lambda}{3}$$

Now visible light has wavelengths from about 4,000 Å to 7,000 Å, and if we take 6,000 Å as an average figure, we find that d for an oil immersion microscope is about 1/50,000 cm., or 1/125,000 in. This then gives the minimum value of d that can be seen clearly when magnified, assuming that the eye is sensitive enough, which point will be discussed below. If we imagine the distance d to be that separating two points, either isolated or points on an object, then the above considerations mean that this distance is the smallest that can be resolved into two points in the microscope system. In other words, two points on the object closer together than d will not be separated into two separate points in the magnified image. If this happens it means that details in the object will not appear in the image. There is no point in photographing the image and then attempting to enlarge the photograph, because if the details are absent in the original, photographic magnification will only increase the amount of blurring. The amount of magnification is therefore limited by the amount of resolution obtained from the microscope, and this problem of resolution is fundamental to the subject.

Resolution

The resolution, or resolving power of a microscopic system is then the minimum distance apart of two points on the object which can be seen as two separate points in the image. If the unaided eye is used to view the image, we must also consider the resolving power of it in order to find the maximum magnification that can be obtained with any system. The resolution of the eye is about 1/250 in., or about 0.1 mm. If a microscope has a resolving power of 1/50,000 cms., then two points separated by this distance will need

* National College of Rubber Technology.

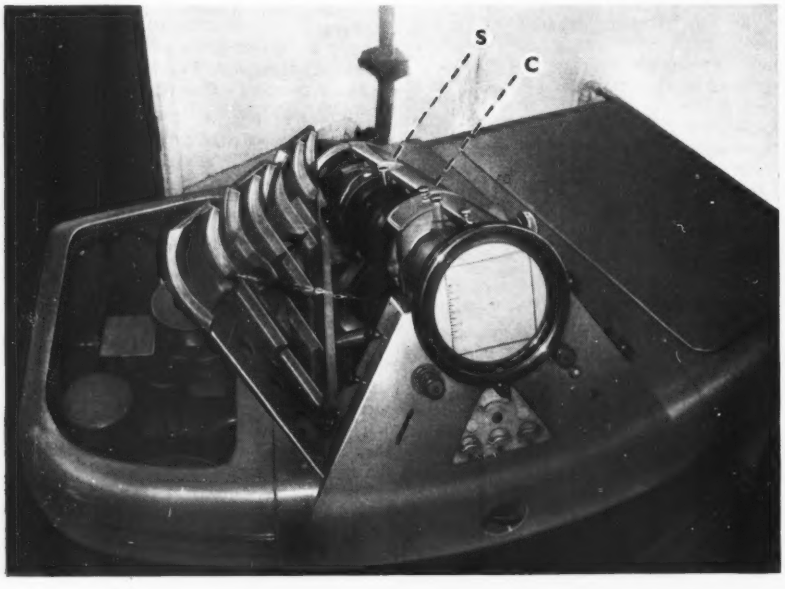


Fig. 1. The Philips E.M.100 electron microscope.

a magnification of 50,000 × 0.01 = 500 to just become visible to the naked eye as two separate points. This degree of magnification is easily obtainable, so that the use of the eye does not limit the useful magnification of an optical microscope. Rayleigh's formula gives the limiting resolving power, which is about 2,000Å with visible light for a very contrasty object. If we use maximum aperture, which is determined purely by the microscope objective lens and the refractive index of the medium between this lens and the object, then the resolution attainable depends entirely upon the wavelength of the light used. This is why a better resolution can be obtained using ultra-violet light, when a resolving power of about 1,000 Å is possible leading to a magnification of about 3,000 diameters. In practice, the aberrations in the lenses also decrease the possible magnification, so that the actual resolving power of a microscope will be less than that predicted by Rayleigh's formula. It is obvious, therefore, that the only way to increase the magnification is to decrease the resolving power by the use of light of a shorter wavelength.

The Electron Microscope

It can be shown that electrons accelerated by a high voltage behave in many respects as if they were short wavelength radiation. For electrons accelerated under voltages from 40 kV. to 100 kV., which is the voltage range available in the Philips electron microscope, model E.M.100, the wavelength associated with the electrons is of the order of 0.01 Å, so that, in theory, a resolution of the order of 10^5 times that of the optical microscope should be attainable. The numerical aperture of the electron microscope leads to a theoretical resolving power of 8 Å, but, in practice, the limit of resolution is rather worse than this, owing to electronic difficulties, and the actual resolving power which can be obtained is about 25 Å or a little better, with the Philips' E.M.100 microscope. In order to magnify two points 25 Å apart so as to produce an image acceptable to the eye, that is, to produce an image in which the two points are 0.01 cm. apart, would need a magnification of 40,000, which can be easily obtained. At the present time, the electronics have been so developed as to enable a direct magnification of up to 80,000 diameters to be obtained. Since the resolution is there, it is possible to magnify further by photographic means until a magnification of about 400,000 is produced. At this magnification, 25 Å appears as 1.0 mm., so that a lack of definition becomes apparent.

Construction of the Electron Microscope

The object, therefore, of the electron microscope, is to produce a beam of electrons accelerated by a high voltage, pass these electrons through the specimen, and produce a magnified image visible to the naked eye. The electrons are produced by heating a tungsten wire filament, in the form of a hair-pin, to incandescence by an electric current, focusing the electrons through a small aperture containing a circular hole of diameter about 20μ, and accelerating them to a high velocity by applying a high voltage between the filament and a perforated anode. Increasing the accelerating voltage increases the penetrating power of the electrons, and also improves the resolving power of the microscope because the wavelength of the electron is smaller the greater its velocity. The electron beam now passes through the lens system and the specimen, and finally falls on to a fluorescent screen to produce a visible magnified image. The lenses of the microscope may be either electrostatic fields or magnetic fields, because electrons are deviated by them in a similar manner to deviations of visible light rays by glass lenses. A diagram of the electron paths in an electron microscope is very similar in appearance to the ray diagram of an optical instrument. In the electron microscope, however, the properties of the lenses may be altered by adjusting their voltages or currents, so that no mechanical focusing devices are required. The lens system must be contained in a tube which is highly evacuated, to prevent scatter of the electron beam by air molecules. So in addition to the tube, or column, containing the electron gun system at one end and the screen at the other, an efficient pumping system is needed. To prevent instability, a complicated electronic stabilizing system, which keeps the lens currents constant to about one part in 50,000, together with vacuum monitoring equipment and power packs, is also required. In the Philips' microscope, which is the one we shall describe here, the vacuum pumps are at one side of the console, and the electronics at the other side, the column being between the two, as shown in the photograph (Fig. 1). This photograph shows the fluorescent screen at the end of the column, one side cover of which is shown open. On the left can be seen the tops of the pumps and reservoir, whilst to the right of the column is the electronics compartment. Below the screen is a panel containing a magnification meter, amongst others, and just above this panel are two control knobs which move the specimen in the beam. The kilovolt selector switch can be seen at the bottom of the picture. The cover of the camera box, labelled C, is indicated, and the top of the specimen holder is just above this at S.

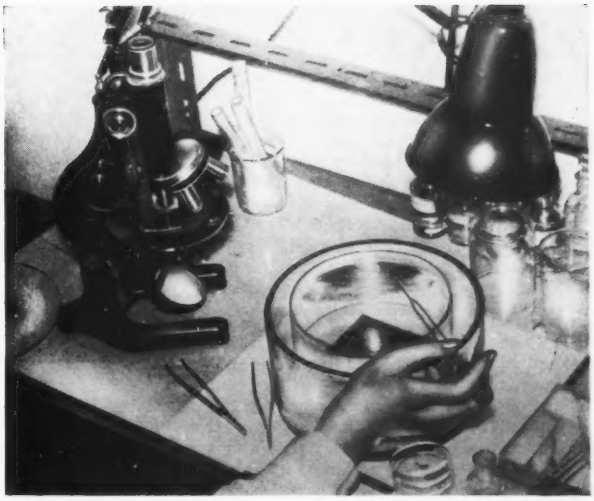


Fig. 2. Preparation of the supporting film. Dropping collodion in amyl acetate on to clean water.

The Specimen Holder

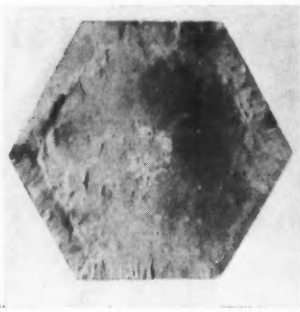
Electrons are easily absorbed by matter, so that it is essential that the specimen, through which the beam has to pass, be extremely thin. The order of thickness must be of 1,000 Å or less, and for this reason special techniques must be used to prepare the specimen. The method used depends upon the material, and this will be dealt with later. The specimen is placed on a specimen holder, or grid, of which there are two main forms. The Philips grid consists of a silver plate, about 5 mm. by 3 mm., having a central slot 1 mm. by 0.1 mm., and the specimen to be viewed must fall on to the supporting film covering the hole. The alternative form of grid consists of a copper disc 3 mm. in diameter, the central portion of which is perforated to form a mesh of 200 per inch. Both these types of grid are held in a clamp at the lower end of the specimen holder, and placed in the microscope column through an air-lock. The preparation of the specimen so that it falls over the slot or mesh is one of the most difficult parts of electron microscopy.

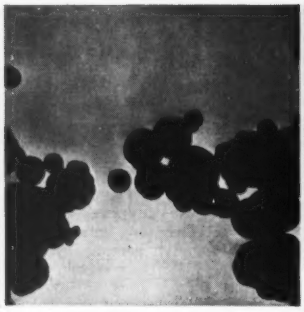
Preparation of Specimen

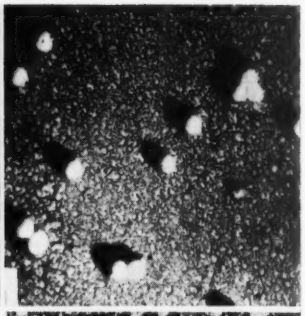
If the specimen to be viewed is a powder, it must generally be supported on a film covering the slot or grid, although occasionally the particles will adhere sufficiently well to the edges of the holder aperture without the need of a supporting film. Such materials as zinc oxide and carbon black particles do not need a film, and can be collected by simply holding the specimen carrier in the vapour or smoke produced by heating. When a supporting film is required, it is prepared as follows.

Preparation of the Supporting Film

A large Petri dish is filled with water, the surface of which is carefully cleaned, firstly by floating filter papers upon it, and then by use of the supporting film material. The apparatus used is shown in Fig. 2. When the water surface is sufficiently clean, a drop of collodion in amyl acetate, or any solvent which will spread on water, is allowed to fall into the centre of the water surface. The surface tension causes it to spread over the entire surface, and the evaporation of the solvent leaves a very thin film of the polymer floating on the water surface. If diffraction colours, or anything other than a faint whiteness can be seen, the film is too thick. If the film does not spread evenly to the edges of the dish, which should be about 15 cm. in diameter, the water surface is not completely clean. Having obtained a satisfactory film, this must be transferred to the specimen grids. To do this, about 12 grids are dropped on to the film, a clean glass microscope slide is pressed down on top of them, pushed under the water surface and brought out inverted in a circular motion. The grids will now be resting on the upper surface of the slide, covered by a layer of supporting film.







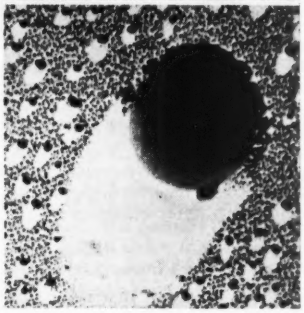


Fig. 3. Acicular ZnO particles from burnt Zn foil.

Fig. 4. Crystal of pearlescent material.

Fig. 5. Carbon black particles.

Fig. 6. P.V.C. latex shadowed by gold-palladium.

Fig. 7. P.V.A. latex particles shadowed with gold.

There are various modifications of this technique which will not be mentioned here. The slide and grids are covered and left to dry, and then cut round with a scalpel, so that they can be lifted off individually and examined one by one in the microscope for cleanliness. Formvar and carbon can be used to make supporting films, but the techniques for these materials will not be described here.

Mounting the Specimen

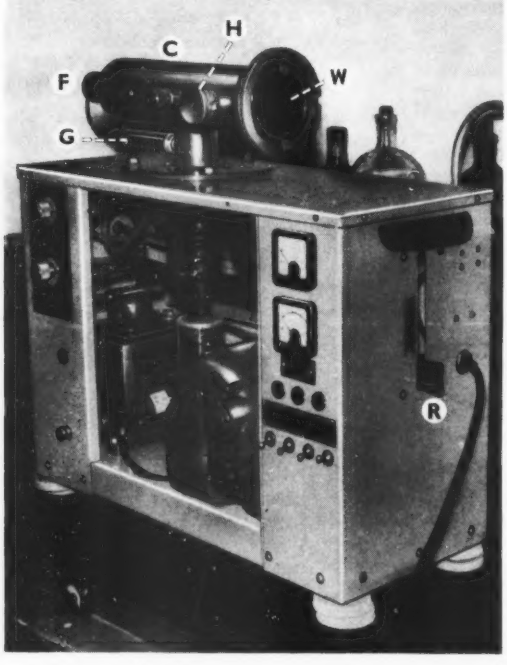
If the specimen is a powder, it can be dispersed in a suitable medium, and a small drop of it placed on a prepared grid and allowed to evaporate. It is sometimes possible to dust the powder straight on to the film, or else to use an atomizer. Some examples of particle photographs are shown in Figs. 3, 4 and 5.

Natural and artificial latices may be examined in a similar manner. Figs. 6 and 7 show some typical examples of latices.

A thin section cut by an ultramicrotome, or a replica, is also placed directly upon the grid, by floating it on a water surface and fishing it out with a copper grid held by a pair of forceps. A supporting film is not necessary unless the section or replica has fragmented, most sections and replicas being self-supporting.

Examination of Latices

It is advisable to make a preliminary dilution of approximately 1 to 1,000 of the latex in distilled water and to examine the resulting dispersion under an optical microscope before proceeding further. It may be necessary to adjust the pH of the dispersion to prevent coagulation. The optical examination gives some idea of the particle size and distribution and it can then be judged how much more dilution is necessary to give a suitable dispersion for the electron microscope. After the dispersion has been obtained, a drop of it is picked up on a platinum loop and placed on the supporting film covering the grid aperture. As a rule, the dispersion is of suitable dilution when it looks like water except for a slight bluey opalescent tinge. Shadowing the specimen with a suitable metal will show up the spherical particles more clearly, although quite good results can generally be obtained from the unshadowed specimen. When shadowing, care must be taken that the metal particles do not flatten the latex particles, giving a false idea of their size. This flattening is avoided by shadowing at a shallow angle of incidence, or by hardening the particles with bromine, although this may tend to swell them. By causing the supporting film to break when it is being examined in the electron microscope, it is possible to see the latex particles on the broken edge of the film, which will bend, and hence the amount of flattening can be observed. This can also be measured by comparing the shadowed and unshadowed images of the same specimen of latex. The latex particles also show a tendency to flatten under their own weight when the dispersing medium has evaporated, and various techniques are available to deal with this, including the use of certain chemicals which slightly swell the particles and hold them spherical. Formulæ are available for calculating the amount of swelling when these chemicals are used, and the effect can therefore be corrected for.



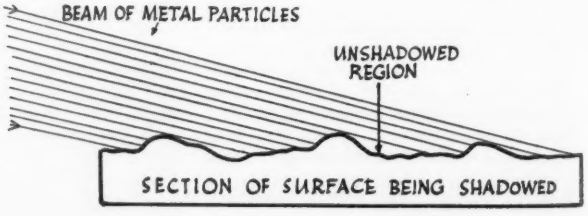
(Left) Fig. 8. Shadow casting apparatus.

(Below) Fig. 9. Shadowing with beam of metal particles. Over the small area of the specimen the beam is effectively parallel.

Shadowing and Replica Technique

The purpose of shadowing is to put a permanent artificial shadow on the specimen so that some effect of solidity is obtained when the specimen is viewed in the microscope. This is done in the special shadow-casting apparatus shown in Fig. 8. This consists essentially of a horizontal cylinder C which can be evacuated by an oil diffusion pump backed by a mechanical rotatory pump. A discharge tube G connected to C acts as a vacuum gauge. At one end of the horizontal tube is a removeable cap F to which is attached a tungsten wire filament. This filament can be made white-hot by a current controlled

(*continued on page 388*)



Patent Review

The following abstracts have been made from specifications at the Patent Office, with the permission of the controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 3s. 6d. each (including postage).

B.P. 797,480. Laminated sheeting. W. E. Simpson. To: Standard Telephones & Cables Ltd.

Layers of copper on a blend of an epoxide or ethoxyline resin and a polyamide resin (40–60%), bonded to polystyrene. The rough side of the copper faces the blend which is cured under heat and pressure.

B.P. 797,571. Waterproof cellulose or regenerated cellulose film, sheets or filaments. To: Bergwerksges. Hibernia A.G. (Germany).

Coated with polypropylene.

B.P. 797,576. Polyurethane foams. To: Farbenfabriken Bayer A.-G. (Germany).

Made stable to fungi, bacteria and other micro-organisms by incorporation of 0.2 to 5% of a tetra-lower alkylthiuram disulphide or a di-lower alkyl-dithiocarbonate. For mattresses and upholstery.

B.P. 797,584. Fluid-filled plastic containers. L. Rado.

A polyvinyl chloride container with an opening arrangement consisting of two slits on each side of a small seamed fluid-filled body communicating with the main body.

B.P. 797,630. Permanent flexible floor coverings. To: National Starch Products Inc. (U.S.A.).

The use of conventional linoleum manufacturing equipment is possible by using as the binding material for pigments and fillers a dry granular copolymer of vinyl acetate monomer and a comonomer chosen from the group of the alkylesters of maleic and fumaric acids. The comonomer acts as internal plasticizer.

B.P. 797,720. Closures for collapsible tubes or other containers. B. F. Gassaway.

A plastic dispensing spout with a thin (initially) rupturable membrane. Suction cups are arranged on the inner walls which are collapsed when the spout is to be sealed to create a hermetic seal.

B.P. 797,745. Bags of liquid, pasty, pulverous or granular material, and process for the production, fitting and sealing of such bags. W. Gloeger (Germany).

Two registering apertures are formed in the empty bag of synthetic foil, first used as filling aperture (by an introduced filling tube), then after sealing presenting an eyelet for suspending the bag.

B.P. 797,771. Caps for bottles and like containers. R. W. Birch. To: Kork-N.Seal Ltd.

A one-piece elastic closure and a one-piece cap. An annular rib on the cap engages an annular groove in the closure member so that the cap can be rotated independently of the closure member which, however, is removed with the cap.

B.P. 797,861. Tab assembly for articles made of synthetic resins and the like. Société d'Exploitation des Plastiques (France).

Conventional metallic rivets may lead to damage in respirators, helmets, pockets, etc. Headed pins of bondable synthetic resin plastics for insertion into flaps with suitable apertures will prevent this.

B.P. 798,002. Closure for a cartridge case and like containers. To: T. W. Hand Fireworks Ltd. (U.S.A.).

Sharp edged thin metal discs for polythene (molecular weight 22,000) cartridge cases.

B.P. 798,013. Cooling and drying thermoplastic film. To: United Plastics Ind. Inc. (U.S.A.).

A liquid coolant is applied in direct contact with the film to set the finish while still on the roller. The liquid is removed by suction when the film leaves the roller and before it is wound into mill-roll form.

B.P. 798,045. Method for manufacturing pipes and the like from armoured plastic material. To: Cie. de Pont-à-Mousson (France).

The armouring (tubular braid) is formed on an expandable mandrel which is introduced into the mould (for centrifugal casting), expanded to apply the armouring, then contracted and withdrawn.

B.P. 798,046. Closures for bottles and like containers. E. Zimmermann (Germany).

Instead of cotton wool for eliminating rattle of tablets in boxes, etc., a hollow stopper is used with elastic helical bars. It may have external sealing ribs.

B.P. 798,048. Arch and heel supports for footwear. M. Friedmann.

A plastic metal reinforced structure, especially for women's shoes.

B.P. 798,058. Droppers. W. R. Morton. To: Anchor Glass Co., Ltd.

B.P. 798,063. Process for the finishing of artificial hides or leathers. A. A. Alegre.

One or more synthetic resins are applied to the surface. They may be combined with water pastels and are preferably prepared with casein.

B.P. 798,069. Squeeze-to-use containers. To: Bradley Container Corp. (U.S.A.).

The container has a thin but self-sustaining plastic wall of uniform thickness treated so as to relieve all strains in the plastic. It is provided with a metallic bottom end closure and may have a similar closure on top with a dispensing head.

B.P. 798,078. Cigarette or like holders. R. F. Power.

For use with filter cartridges. It is designed for easy removal of the filter while preventing smoke passing around the filter when inserted.

B.P. 798,080. Imitation gems consisting of glass, transparent plastics or the like. To: Simili Fabrik Feiner Schleifprodukte Anstalt (Austria).

With a coating to reflect a major proportion of incident light.

B.P. 798,175. Manufacture of artificial flowers of moulded plastic material. A. E. Decamp (France).

Characterized by a number of superposed, petal-carrying hubs of decreasing perimetrical sizes.

B.P. 798,194. Method and apparatus for producing films of organic thermoplastic material. To: Dow Chemical Co. (U.S.A.).

The film is drawn and stretched multi-directionally in one continuous operation exhibiting uniform elongation at break in all direction parallel to the surface of the film. Fused organic thermoplastic material is continuously distributed as a unitary thin sheet from a central feed point and slit radially at fixed points. The separated sheets are each individually grasped and conveyed radially away at a rate corresponding to the rate of extrusion.

B.P. 798,262. Supports for soap cakes. A. A. Beaumont.

Dished plastic shoes pressed into the soap cake to prevent its underside from remaining wet when put aside on these shoes.

B.P. 798,277. Protective headgear. J. P. Crouzet (France).

A transparent casing with breathing-pores surrounding the head as a protection against inclement weather.

B.P. 798,338. Dispensing containers. E. Levy. To: Crystal Products Co., Ltd.

The container is pleated or corrugated to facilitate the squeezing action.

B.P. 798,398. Fibre-reinforced synthetic laminates. J. C. Newson, W. T. Nun. To: Mendip (Chemical Engineering) Ltd.

A surface layer of fibre material bonded with an epoxy resin, integrally backed with a fibre layer bonded with a polyester resin.

B.P. 798,446. Foamed cellular alkyd resin-polyisocyanate plastic materials. To: Nopeo Chemical Co. (U.S.A.).

A reaction product of a mixture of a compound containing more than one isocyanate group and an alkyd resin of an acid number of between 5 and 80, particularly for the production of foamed plastics of the rigid type.

B.P. 798,536. Tamper proof caps for bottles and other receptacles. To: Tapex Trust Reg. (France).

Weakened zones formed between the upper edge of a skirt and ribs on the cap moulded integrally as an extension of the ribs around the outer periphery of the cap. This skirt has to be torn away along the weakened zones to permit removal of the cap.

B.P. 798,570. Containers. J. R. Morris. To: Rounk Ltd.

With two lids which can be screwed together or engage one within the other with a good friction fit.

B.P. 798,603. Flexible elastomeric hose and method of making same. To: Raybestos-Manhattan Inc. (U.S.A.).

It has been found that a superior hose can be constructed of a thin-walled inner tube composed of polytetrafluoroethylene or polymonochlorofluoroethylene and an outer tube of, e.g. rubber although the materials will not bond. On the contrary, internal stresses are minimized by the inner tube serving as a liner which can slip.

B.P. 798,604. Liquid coating compositions. To: E. I. Du Pont de Nemours & Co. (U.S.A.).

Water or moisture blistering in a paint failure especially on the outside of wood houses. A coating resisting water blistering is characterized by an air-drying organic film-forming material and a particulate water-insoluble polymeric reaction product of at least one polyanionic linear polymer and at least one polycationic polymer.

B.P. 798,669. Organosiloxane elastomer foams. To: Midland Silicones Ltd. (U.S.A.).

A stannous salt of an aliphatic carboxylic acid is employed as a catalyst to obtain sufficient foaming and rapid curing at room temperature of commercially feasible organosilicon rubber foams which are thermally stable.

B.P. 798,672. Manufacture of leather or fabric faced buckles, buttons and like articles. M. Shenderey.

A hollow buckle without a core is made by affixing a sheet of leather or fabric to one face of an oversized sheet of thermoplastic (polyvinyl chloride) of sufficient thickness to retain a moulded shape. The faced sheet is softened and displaced into a mould. Excess material is later trimmed off.

B.P. 798,673. Coating of silicone rubber articles. To: Connecticut Hard Rubber Co. (U.S.A.).

A protective sheath of polytetrafluoroethylene is fused on to the surface of the silicone rubber articles.

B.P. 798,675. Manufacture of stabilizing pastes for resinous compositions. To: National Lead Co. (U.S.A.).

A basic lead salt of a saturated or unsaturated, monobasic aliphatic carboxylic acid in a liquid organic plasticizer.

B.P. 798,676. Permanent flexible floor coverings. To: National Starch Products Inc. (U.S.A.).

Vinyl linoleum is made with a binder (25% to 35%) of a terpolymer incorporating 60% to 20% vinyl acetate, 10% to 50% vinyl chloride, 20% to 40% comonomer acting as internal plasticizer.

B.P. 798,692. Moulds or other flanging means for pipe ends. R. M. Hilburn. To: Yorkshire Copper Works (Holdings) Ltd.

For joining pipes of polythene, polystyrene, polyvinyl chloride, cellulose acetate. A segmented collar is used with a compression ring to be assembled *in situ*.

B.P. 798,705. Children's cots. F. T. Smith. To: M.S.P. (Lux-Products) Ltd.

Use of polyvinyl chloride for a padded apron and the lining of cot and hood.

B.P. 798,733. Portable commode for use by invalids and others. A. F. Kiddle.

With a polythene bed pan.

B.P. 798,754. Method of producing flat articles. A. Bayetto (Norway).

A soft cheap wood frame to be hot pressed together with a fibrous filling and a phenolic resin binder, e.g. for producing doors.

B.P. 798,805. Stiffening collars or other articles of wearing apparel. E. Kornreich. To: Trubenised (Great Britain) Ltd.

Polythene used as a coating or impregnant for a stiffening member to be fused with cellulose acetate strands in the fabric.

B.P. 798,806. Polymeric adhesives. To: Johnson & Johnson (U.S.A.).

For pressure sensitive transparent tapes which will not stick to themselves but tenaciously adhere to other objects. The composition comprises a maleic anhydride/styrene copolymer esterified and reinforced by cross-linking with a reinforcing agent.

B.P. 798,808. Manufacture of compact bodies compounded from glass fibres and synthetic materials. To S. A. des Manufactures des Glaces et Produits Chimiques de Saint Gobain, Chauny et Cirey (France).

The bodies after shaping and hardening are impregnated with liquid waterproofing agents (e.g. silanes) having a marked wetting action and penetrates into all pores and cavities.

B.P. 798,837. Safety devices for mills and the like for rubber, plastic and like material. J. Brown, H. Ellwood. To: David Bridge & Co., Ltd.

A guard for the scraper connected with it in such a way that it remains effective until the scraper is in its operative position.

B.P. 798,862. Injection moulding process and apparatus for carrying out said method. K. W. Spillm An. To: Parker Pen Co.

The core for forming a tubular ink container of polythene is insertable and removable from one end of the moulding cavity using a sleeve slidable on the core for preventing deflection when the heated liquid material is injected into the mould.

B.P. 798,886. Display-device for cut flowers. C. Ragot (France).

With pins for impaling the flowers on a support with a suction cup underneath.

B.P. 798,900. Dispensing closures for containers. W. S. Wilson (U.S.A.).

With parts of polythene one of which serves as screw cap the other one turning in a transverse bearing formed on the apertured top of the cap from closed position (horizontal) into open position (vertical).

B.P. 798,908. Plastic cups and like receptacles. R. E. Smucker. To: Crown Machine & Tool Co.

Thin cups nested telescopically together for transport are easily damaged. The cups are therefore made with interior shoulders near their bottoms so that always a small clearance remains between the convergent walls of the cups so as to prevent jamming.

B.P. 798,912. Vaporizing volatile components from viscous or plastic solids. To: Welding Engineers Inc. (U.S.A.).

The composition is polymerized to a predetermined point short of completion, then fed in flat helical ribbon formation under controlled further polymerization on to an area of restriction in an isolated extractor chamber of low pressure. The composition without its volatile components is finally passed under further controlled conditions towards the discharge.

B.P. 798,954. Picture and like hangers. J. R. Spark.

A figure (clown, elf, pixy, sailor, animal, etc.) having hooks being formed by hands and/or feet.

B.P. 798,973. Moulding of boat hulls from synthetic resin bonded glass fibres. A. G. W. Hall. To: Watercraft Ltd.

The mould is provided with a detachable portion to receive fibre and resin and to form the material into a lateral projection on the hull. The portion is then withdrawn from the mould leaving the moulded projection on the hull.

B.P. 798,975. Method and device for bending C-stage post-formable plastic material. T. V. Tyler. To: North American Aviation Inc.

Two fixtures are used of which one is movable through a predetermined path. A heated (120° C. to 175° C.) unreinforced portion of the sheet to be curved to the shape of a reinforcing member supported adjacent to the surface of the unreinforced portion, is held in the first fixture and then bent to the desired shape by the movement of the second fixture.

B.P. 799,019. Toilet articles such as combs hinged in covers or cases. To: Jarrett, Rainsford & Laughton Ltd.

With a trip bar and latch part.

B.P. 799,043. Vinylic fillers and the reinforcement of elastic and plastic materials therewith. O. W. Burke Jr. (U.S.A.).

Refers to a liquid suspension of colloidal sized vinylic filler particles for blending with a latex.

B.P. 799,050. Containers of solid, not extensible synthetic materials. C. Friese, A. Mühlenberg (Germany).

The translucent fuel (oil, etc.) container is made of two rectangular body-halves symmetrically formed of thin-walled parts of plastic (polyester) with a (glass) fibre reinforcement. Rim portions of U-shaped cross-section pressed out in the mould are joined to each other by cold-bonding or cold-fusing.

B.P. 799,062. Manufacture of fibre reinforced cross-linked acrylic resin. To: E. I. Du Pont de Nemours & Co. (U.S.A.).

The rate of production of sheeting and other articles is significantly increased by the addition of a cross-linking agent (ethylene dimethacrylate) to an acrylic monomer polymer syrup (mixture of monomeric and polymeric methacrylate).

The Electron Microscopy of High Polymers

(*continued from page 386*)

through the rheostat R. The specimen grid is placed in a clamp which can be rotated through a known angle by the knob H which is graduated. A window W, which is removeable, allows the specimen to be put in and withdrawn. The shadow is produced by hanging a small rider of suitable metal over the loop of the tungsten filament, and then raising the tungsten to incandescence when the chamber C is evacuated. The metal rider melts, and metal particles are evaporated off and travel away from the filament in straight lines. Some of these particles pass over the specimen, as shown in the diagram, Fig. 9, and form a permanent deposit on the supporting film or replica surface. The portion of the specimen which would have been in shadow had a beam of light been shone in the same direction over it will not have any metal particles on it, whilst the rest of the specimen will be covered with a uniform layer of metal. When this is observed in the microscope, more electrons will pass through the unshadowed part, so that a reversal takes place, and a shadow is seen which is brighter than the surrounding area. This is shown in Fig. 7. A black shadow can be easily obtained when the photograph is printed.

The vacuum required in the chamber is about 10^{-5} mm. of mercury. The heating current for the tungsten filament depends upon the type of shadow required and the material of the rider. The metal of the rider melts into a small globule and flows over the surface of the tungsten before finally evaporating. Materials used for riders include Minalpha alloy, a special alloy of copper, aluminium and manganese, gold-palladium alloy, pure gold and pure silver, chrome, nickel, silicon oxide, carbon (not used as a rider but obtained from an arc), tin, and aluminium, amongst others. Shadowing materials which are powders, such as antimony, have to be evaporated from a molybdenum boat or a tungsten basket, The size of the metal particles produced depends upon the rate at which the rider is evaporated, and therefore upon the vacuum and the heating current. The correct adjustment of these for any particular metal is mainly a matter of experience, and all that can be said is that the finer particle size is obtained by using a stronger heating current through the filament.

(*to be continued*)

We can show you that
MELLITE
Organo Tin Stabilizers
are essential for adequate protection of transparent rigid vinyl compositions at temperatures encountered during calendering or extruding. Being liquid they are easy to incorporate and because they are compatible with the vinyl matrix, complete transparency and clarity is assured.
ALBRIGHT & WILSON (Mfg) LTD
ORGANIC CHEMICALS DEPARTMENT
I KNIGHTSBRIDGE GREEN
LONDON · S.W.1 Kensington 3422
Our Technical Service Department is equipped to advise on the use of these stabilizers and to show results and ageing tests. Write for Data Sheets, samples and information.
TRW 460

WWB precision mouldings
Found on many Assembly Lines to-day
You can count on WWB Precision Mouldings
from the production line at . . .
BURSTEAD WORKS, KENNEL LANE
BILLERICAY ESSEX.
W.W. BALL & SONS LIMITED
BURSTEAD WORKS, KENNEL LANE
BILLERICAY ESSEX.
Over 30 Years Experience in the Plastics Industry
A Complete Service in . . .
Design . . Toolmaking . . Engraving
Compression, Transfer and Injection Moulding
Colour Blocking . . Finishing
Assembly and Packaging

WWB

Offer a Complete Service in:

Design · Toolmaking · Engraving
Compression · Transfer & Injection
Moulding · Colour Blocking
Finishing · Assembly & Packaging

Our long experience in the Plastics industry covers over 30 years, you can be assured that the advice we give is sound. Consult us NOW.

W. W. BALL
& SONS LIMITED

KENNEL LANE
BURSTEAD WORKS
BILLERICAY ESSEX

phone: BILLERICAY 1133/4
grams: PLASTOOL BILLERICAY

Because of popular demand we have reintroduced the HUPFIELD PLASTIC GRANULATOR. Redesigned and more powerful this model is mobile and readily accessible for cleaning.

All inquiries for this and the HUPFIELD 1¼ oz. and 2¼ oz. INJECTION MOULDING MACHINES to Sole Agents.

Telephone: DAVENTRY 257

PLANT INSTALLATIONS LIMITED
WELTON MANOR, Nr. DAVENTRY, NORTHANTS

Telegrams: PLANT DAVENTRY

PLASTICS ELO PRODUCTS

BIRKBYS LTD. LIVERSEDGE, YORKSHIRE

London Office :- 79 Baker Street W.1.

The Craftsmen of Britain

Britain's pottery is famed throughout the world, from the products of the great potteries in Stoke to those of the individual potters working in their one-man studios.

To coax a formless lump of clay into a shape of lasting beauty is the potter's pride. To machine a lump of metal into a mould of lasting reliability is the task of the Craftsmen of Tyburn Road. The charm of pottery lies in its individuality. The requirement of a mould is that it should show none; rather that it must have a precision and perfection of finish to which many anonymous craftsmen contribute their highest skills. Mould-making is teamwork, and at Tyburn Road we have built a team of perfectionists, second to none, which wins orders on an international scale.

The Craftsmen of Tyburn Road

B.I.P. TOOLS LIMITED

Tyburn Road · Erdington · Birmingham 24 · Phone: Birmingham East 2061 · Grams: Plasmould B'ham 24

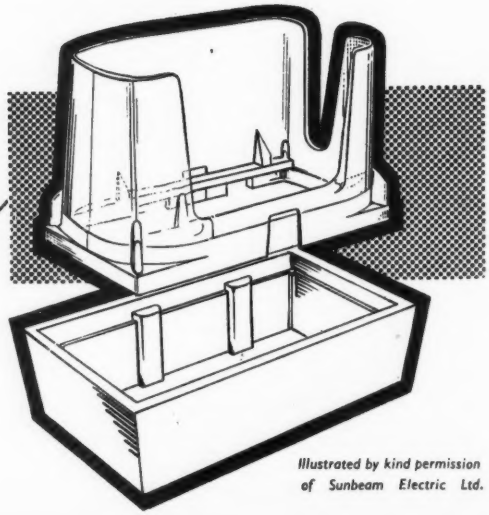
B·I·P

MEMBER OF THE GAUGE AND TOOL MAKERS' ASSOCIATION

to display the world's finest electric shaver

only the best is good enough . . .

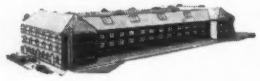
Perfect display at the point of sale—the aim so many strive for but so few achieve. What better way than to design the display using clear plastic mouldings? The Sunbeam ' Shavemaster ' display is a particularly interesting moulding. Made in two sections, cemented together, it gives both rigidity and visibility. Plastic displays and plastic containers are something at which we excel. We would welcome your enquiries, our technical advisory service is at your disposal.



Illustrated by kind permission of Sunbeam Electric Ltd.

Victoria Works (Summer Lane)

Walsall Works (Eldon Street)



E. Elliott Limited

the plastic moulders with the engineering background

Walsall Works (Bescot Crescent)

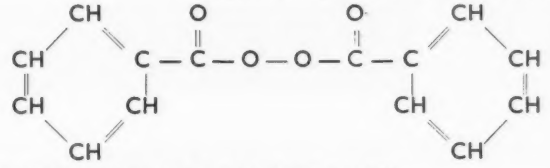
Cheapside Works

315 SUMMER LANE, BIRMINGHAM, 19. Tel: ASTon Cross 1156-7-8-9

LUCIDOL

BENZOYL PEROXIDE

THE MOST OUTSTANDING AND
ECONOMICAL ORGANIC PEROXIDE



IT IS NOT GENERALLY REALISED THAT:

LUCIDOL CAN BE USED FOR THE WIDEST RANGE OF APPLICATIONS:
for bleaching oils and waxes,
for oxidising organic matter,
for catalysing polymerisation.

LUCIDOL CAN BE OBTAINED IN THE WIDEST RANGE OF FORMS:
as pure powder,
as pastes in plasticisers,
as pastes in silicone fluids,
as fine powders with extenders,
as various solutions.

LUCIDOL CAN BE USED AS CATALYST IN THE POLYMERISATION OF POLYESTER RESINS IN THE WIDEST RANGE OF CONDITIONS AND TEMPERATURES, SUCH AS
completely submerged,
exposed to air or gas,
in vacuum or pressure bags,
in metal moulds,
at temperatures as low as 35° F.
as high as 600° F.

Noury

NOVADEL LTD.

ST ANN'S CRESCENT
WANDSWORTH
LONDON S.W.18
VANdyke 7761-5

A LITTLE SQUIRT

For all plastics including thermoplastics, thermosettings, laminated resins, rubber, synthetic rubber and other high polymers, Ambersil is the finest mould release agent available today. It comes in two grades: Formula One is a pure methyl silicone fluid of considerable properties including a virtual non-inflammability, whilst Formula Two is solvent diluted producing a finer spray but with lower flash and ignition points. The use of the second type should therefore be restricted to moulding operations at the lower temperatures. Formula One is also a first class "anti-stick" for unlimited application - apply it where sticking must be avoided, just a little squirt.

The following prices are at present operative for the 12 ounce Aerosol containers:-

	Singles	½ dozen	1 dozen	2 dozen
Formula One	18/-	17/- each	16/- each	15/- each
Formula Two	16/-	15/- each	14/- each	13/- each

AMBER OILS LIMITED · 11a Albemarle Street · London · W1 MAY 6161

PROGRESS IN PLASTICS

VACUUM FORMING
FABRICATING

DISPLAYS
SHOWCARDS

PRINTING

Craftsmen in all Thermoplastic Sheeting
for over 30 Years

CELLGRAVE
COMPANY LIMITED

ALPHA HOUSE · CHOUMERT ROAD · LONDON · S·E·15
NEW CROSS · 0328-9

Now there are 4 new SURFORMS

FINE-CUT FILE No. 102

This SURFORM file has been developed specially for mild steel and other tough materials. The cutting principle is the same, but the teeth are set at a different cutting angle, giving a clean cut and a smooth finish. Price **12/6**.—Replacement blades (No. 506) 3/6.

BLOCK PLANE No. 111

This fine-cut tool is for quick, one-handed smoothing of edges and small surface areas on a wide variety of materials. You will find scores of uses for it around your workshops. Price **10/-**. Replacement blades (No. 520) 2/9.

CONVEX PLANE No. 105

Although developed for the car-body repair trade and for spot-trimming, this fine cut convex SURFORM is very fast and efficient on wood too and is ideal for the furniture and cabinet making industry. Price **17/6**. Replacement blades (No. 506) 3/6.

HALF-ROUND FILE No. 103

Here's another tool for which we had many requests. It gives first class results on concave surfaces and will serve many trades. Price **13/-**. Replacement blades (No. 507) 4/3.

The universal tool with hundreds of uses!

SURFORM

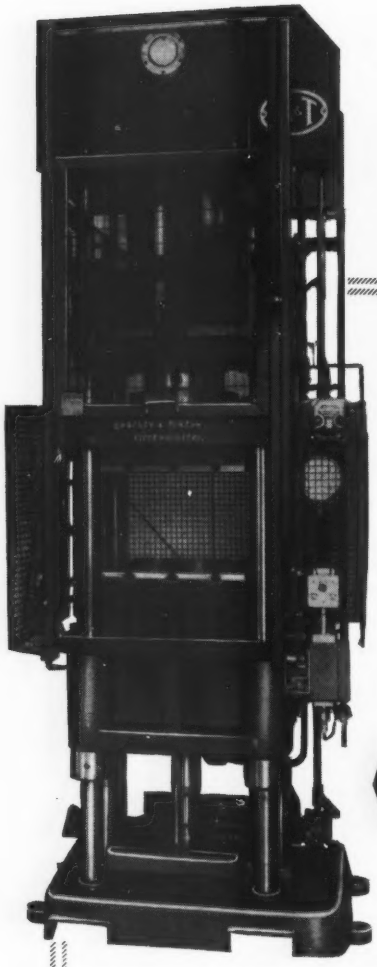
The new tools are supplementary to the original SURFORM plane and file, which remain the ideal all-purpose cutting and finishing tools for every industry. Plane type (No. 107) **17/6.** File type (No. 101) **12/6.** Replacement blades (No. 505) **3/6.**

SURFORM blades (an invention of Firth Brown Tools Ltd.) are made from hardened and tempered Sheffield tool steel—they give controlled depth of cut and never clog with waste material.

A product of SIMMONDS AEROCESSORIES LIMITED, Treforest, Glamorgan. **A MEMBER OF THE FIRTH CLEVELAND GROUP**

CRC 29 SU

K

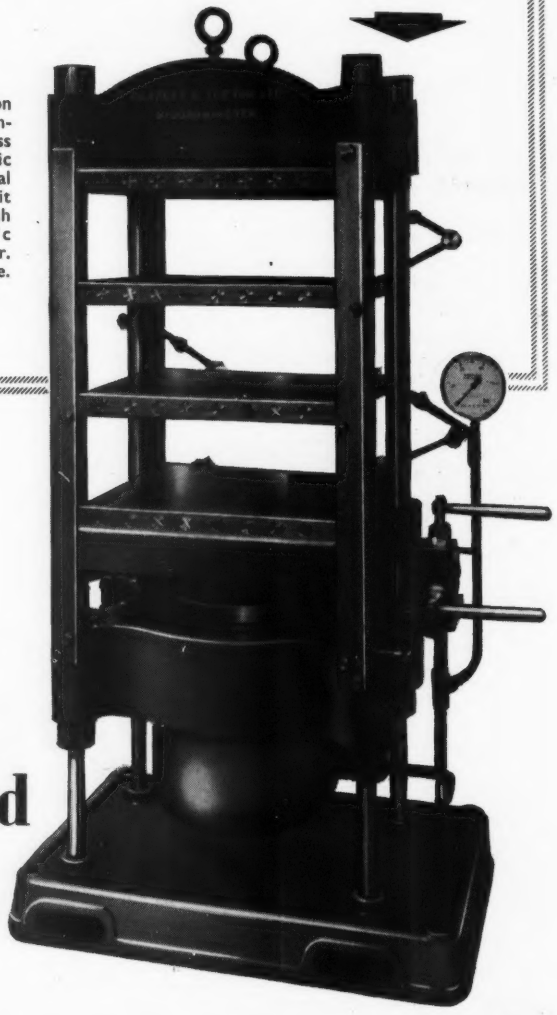


B&T

PLASTICS AND RUBBER MOULDING EQUIPMENT

No. 202R. 50-ton Upstroking Moulding Press with four 24-in. square Steam Heated Platens. Suitable for accumulator or direct pump system.

No. 936. 150-ton Self-Contained Down-stroking Moulding Press with semi - automatic ejector gear and integral motor driven pump unit and fitted with push button Automatic Process Controller. Platens 20 ins. square.



Presses: Upstroking, Downstroking, Side Ram and Multidaylight.

Pumps: Variable and fixed delivery.

Accumulators: Gas and ballast loaded.

Process Controllers: Push button operated.

Pelleting Presses, etc.

Bradley & Turton Ltd

CALDWALL WORKS, KIDDERMINSTER

Telephone: 2217-8

Telegrams: " Wheels Kidderminster "

THE LEADING MANUFACTURERS OF COMPRESSION MOULDING EQUIPMENT

...man's best friend

THE BRITISH PLASTICS FEDERATION

Telephone
COLINDALE
2266/7/8
Telegrams
PUNFIBARS
HYDE
LONDON

P & B
INJECTION
MOULDING
Specialists

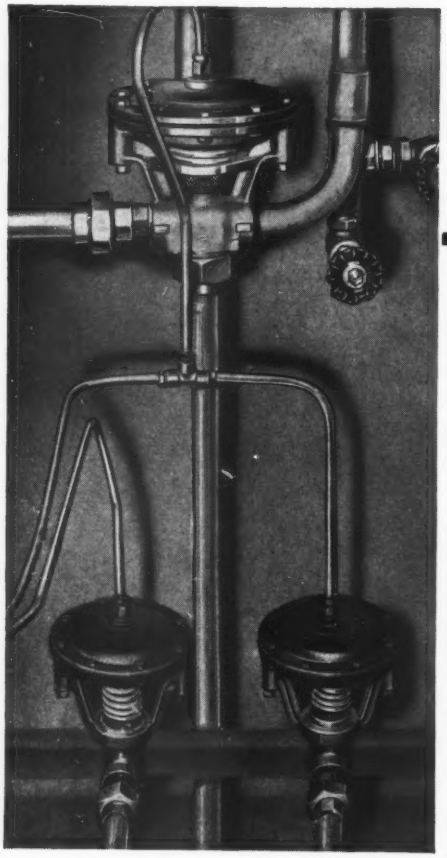
If you've run into trouble and don't quite know how to tackle the job, why not consult us? After all, problems such as yours are not difficulties to us; we overcome them every day!

The least of your worries should be plastics, so send them to us. We'll be really pleased to help.

Punfield & Barstow

★ WHERE LIABILITY STARTS AND FINISHES ON TIME! ★

PUNFIELD & BARSTOW (MOULDINGS) LTD., BASIL WORKS, WESTMORELAND RD., QUEENSBURY, N.W.9



when time matters

AND GREATER OUTPUT IS WANTED

Make your existing moulding presses work *harder* and *faster* by converting to automatic control with Hunt & Mitton valves. Installation is quick and simple, moreover the increased factory saving far outweighs the original cost !

We manufacture over 500 different valves up to 18" steam and $\frac{1}{8}$" air, for manual or automatic control.

CHANGE TO

HUNT & MITTON LTD

Quality **VALVES**

* **Why not write to us NOW for further details of this inexpensive way to greater production.**

Have you a TUBE PROBLEM?

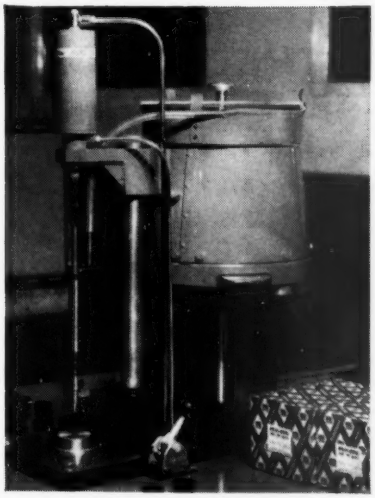
—*if so, let us solve it*

As a user of tubes—metal or otherwise—just consider whether or not a PAPER tube will do the job. Our paper tubes, **made of special quality paper, are impregnated with Thermo-hardening resins.** Strong, light in weight, they show a definite economy in cost. Used increasingly with every satisfaction in many industries. It will pay you to investigate this. Write to :

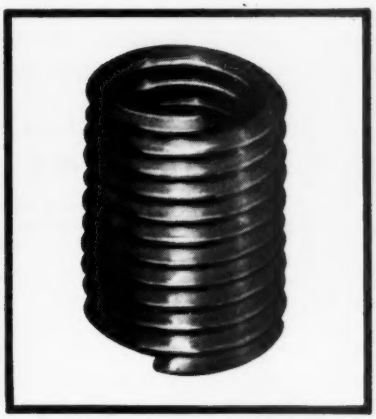
THE TEXTILE PAPER TUBE CO. LIMITED

OAKWOOD MILLS · ROMILEY · NR. STOCKPORT

Telephone : Woodley 2271-4



a ready-made solution to many problems in plastics



HELI-COIL*

push type insert

A metal screw thread insert
that eliminates tapping, solid bushing...
and wastage of time and materials...
has saved more than ½d. per hole!

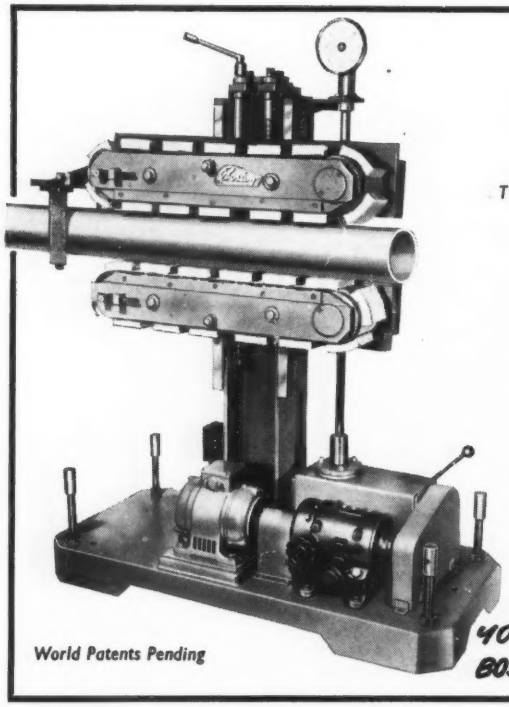
The Heli-Coil Push Type Insert — an epoch-making development — makes the strongest possible appeal to the progressive technician. It opens up a whole new field of simplification and improvement by providing low-cost, secure fastening of non-structural parts for the high production market. In a quick, simple operation the Heli-Coil Push Insert permits the insertion of ready-made self-anchoring female threads in plastic parts and light alloy materials. Difficulties caused by the poor screw thread properties of these materials can now be relegated to the past. No rejects because of blind or untapped inserts or inserts with insufficient thread depth will be found on the assembly line. The Heli-Coil Insert, by its nature, cannot be made without a thread.

The Heli-Coil Push Type Insert can be hopper fed and power inserted into the component after moulding, permitting a high speed moulding operation. It is a necessity for the automation production line layout. Installation tooling can be had on purchase or rental. May we make an investigation for you?

For further details write dept. HP2.

ARMSTRONG PATENTS CO. LTD. EASTGATE, BEVERLEY, YORKS. Tel. Beverley 82212

* *HELI-COIL is a registered trade mark*



World Patents Pending

THE BOSTON UNIVERSAL 'TAKE OFF'

THE EIGHT STAR MACHINE WHICH MEETS ALL YOUR NEEDS

- ★ Hauls off all tubes and profiles—rigid, brittle or flexible.
- ★ Instantly adjustable for any size or profile with unskilled labour. No taper rollers to adjust and synchronize.
- ★ Powerful positive non-slip dead centre line haul-off.
- ★ Obviates trial runs. No time or material wasted in starting up.
- ★ One hundred per cent. consistency.
- ★ One hundred per cent. perfect quality.
- ★ Compact and requires little floor space.
- ★ A fine engineering achievement—fully guaranteed.

THESE POSITIVE FEATURES SAVE YOU LABOUR AND MAINTENANCE COSTS, AND AVOID STANDING TIME

YOU GET MILES MORE QUALITY PRODUCTION WITH BOSTON — EVERY FOOT PERFECT AND SALEABLE

Consult us for your special-purpose requirements

Trade Enquiries Invited (Home and Overseas)

BOSTON MARINE & GENERAL ENGINEERING CO LTD

VICEROY WORKS, LOW FIELDS RD., LEEDS, 12, ENGLAND. Tel : Leeds 34261/2/3. Telegrams: Bosmarco, Leeds, 12

Expressly designed

During the past twenty years,

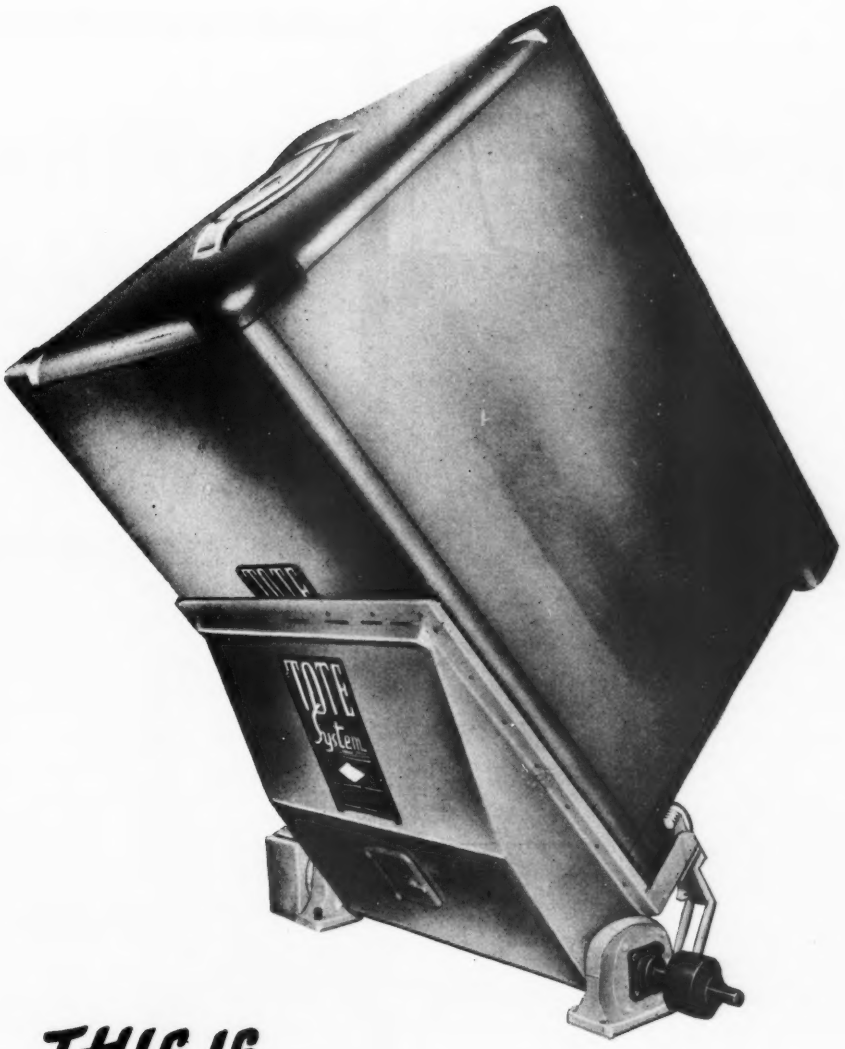
ERMETO designers have developed an immense range of high pressure fittings to suit every conceivable need. If our range does not contain a fitting to suit your purpose do not hesitate to contact us.

Our Technical staff will be pleased to collaborate in the development of any non-standard item.

ERMETO

Details of our standard range of high pressure couplings and valves are available on request.

BRITISH ERMETO CORPORATION LTD · Beacon Works · Hargrave Rd · Maidenhead · Berks
Telephone: Maidenhead 5100 (10 lines)



THIS IS

the TOTE BIN & TILT

which is a simple, infinitely flexible system for Handling and Discharging

BULK MATERIALS

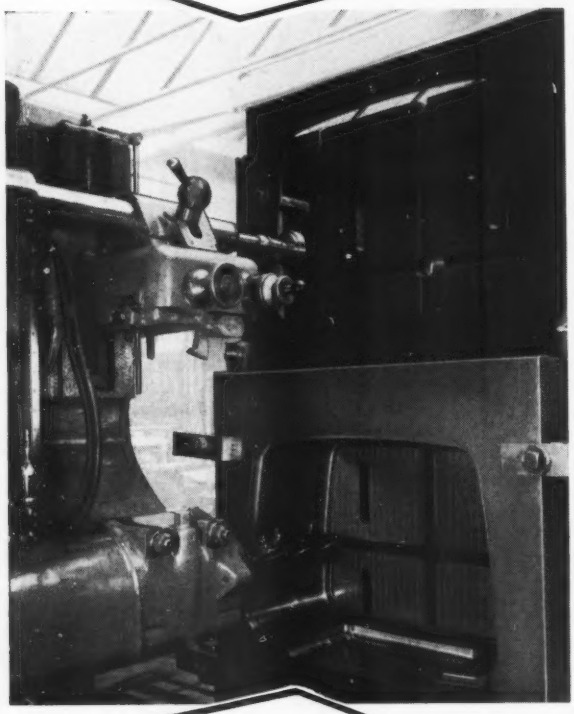
TOTE
BULK MATERIALS HANDLING SYSTEM

May we send you an Illustrated Description of the Complete System

PRESSOTURN LTD. · Leamington Spa, Warwickshire

Telephone: Leamington Spa 7056/7

Pioneers



IN
MOULDS
FOR MODERN PLASTICS
ALSO . . .
JIGS AND GAUGES

BARBER & DUFFY LTD
214/222 CARDIGAN ROAD, LEEDS
'PHONE : LEEDS 52033

Stabilisers for P.V.C.

White Lead* is still the cheapest and most widely used

*(*prepared by our special process)*

Other pigmenting types

Dibasic Lead Phosphite
Excellent Heat and Light stabiliser

Tribasic Lead Sulphate
A special Dielectric Heat stabiliser

Transparent and Translucent Types

Lead Silicate
Metallic Stearates
(Barium, Cadmium, Calcium, Lead, Triklar*).

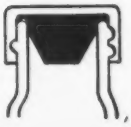
*For efficiency and hygiene White Lead and Triklar are supplied only as dispersed pastes. Other products supplied dry or dispersed in plasticiser at buyer's option.

ASSOCIATED LEAD
MANUFACTURERS LIMITED

SPECIAL CHEMICALS DIVISION, CRESCENT HOUSE, NEWCASTLE UPON TYNE, 1

1 Closure in open position

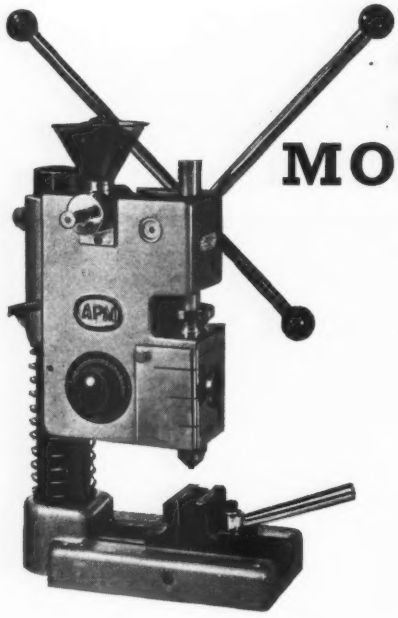
2 Closure in half sealed position

3 Closure in fully sealed position 

John Dale are proud to present this specially designed and patented plastic peg cap with its polythene cone liner which gives **sealed perfection** now available in a range of sizes.

JOHN DALE
LIMITED

NEW SOUTHGATE, LONDON N.11
TELEPHONE ENTERPRISE 1272



APM 21

HAND OPERATED BENCH INJECTION MOULDING MACHINE

★ SUITABLE FOR WORKING THERMOPLASTICS—CELLULOSE ACETATE, POLYSTYRENE, POLYTHENE, etc., with normal cylinder—NYLON with special cylinder.

★ FITTED WITH SEMI-AUTOMATIC HOPPER FEED.

★ CAPABLE OF PRODUCTION RATES, depending upon mould design UP TO 100 INJECTIONS PER HOUR WITHOUT SPECIAL SKILL.

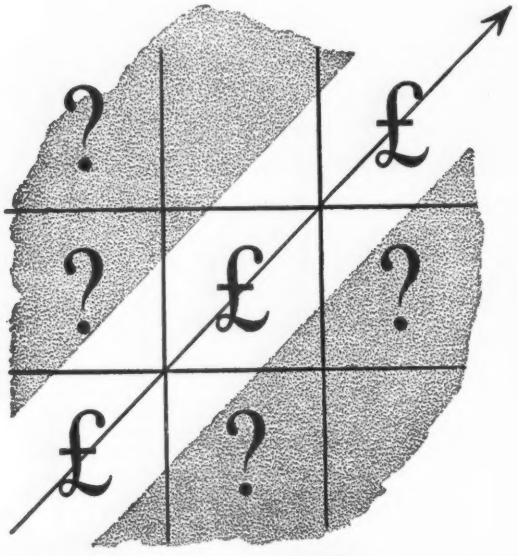
AND TWO TOTALLY NEW FEATURES!

★ FITTED WITH NEW LEAK-PROOF, SELF-SEALING AND INTERCHANGEABLE CYLINDER UNIT (Patented).

★ CAPABLE OF ACCOMMODATING MOULDS OF VARYING SIZES IN NEW QUICK-ACTING CAMLOCK VICE.

ASMIDAR PLASTIC MOULDING MACHINES LTD.

116 VICTORIA STREET, LONDON, S.W.1 Telephone: VICtoria 5554



Turn problems into profits

with PLASTICS

As competition grows keener, more and more manufacturers are turning to Kent Mouldings for the means to keep ahead. A more attractive product . . . simplified assembly . . . substantial reductions in time, labour and production costs—these are typical of the advantages of Plastics Mouldings.

Kent Mouldings specialise in mouldings for electrical, radio and television equipment, telecommunications, computers, toys, bobbins for textiles and a thousand other products.

Next to quality, we pride ourselves on first class service and highly competitive prices.

Perhaps we can help you to improve your product or overcome a production problem. If the job can be done with plastics, you'll get better results from. . . .

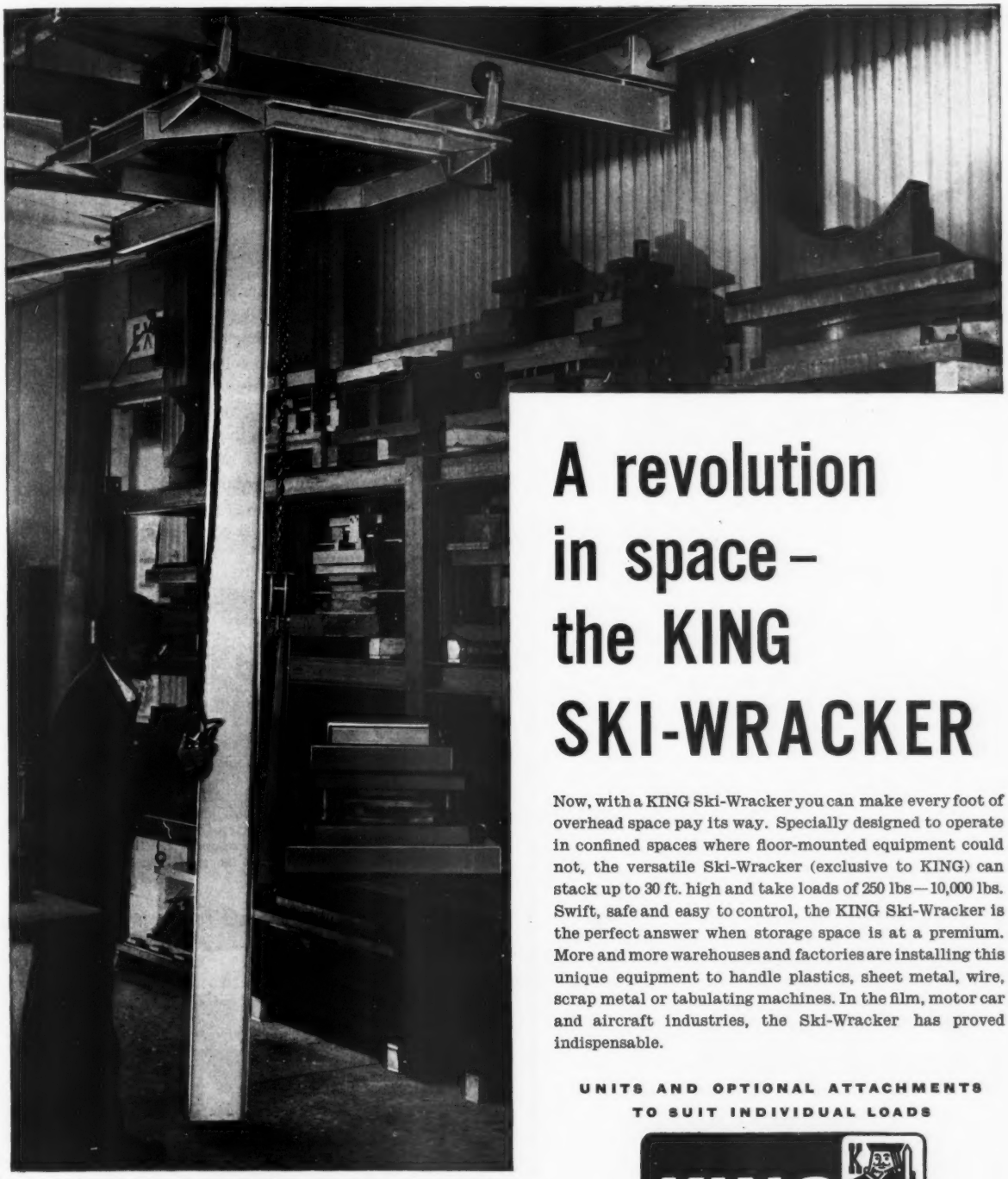
NYLON · UREA RESIN · P.T.F.E. · P.T.F.C.E. · MELAMINE RESIN · P.V.C. · POLYTHENE · CELLULOSE ACETATE · DIAKON · PHENOLIC RESIN · POLYSTYRENE · ALKYD RESIN

for mouldings that matter

KM KENT MOULDINGS

FOOTSCRAY . SIDCUP KENT

Tel: Footscray 3333



▲ *Shown here is the baby* SKI-WRACKER *which handles loads up to 10 cwts.*

A revolution in space – the KING SKI-WRACKER

Now, with a KING Ski-Wracker you can make every foot of overhead space pay its way. Specially designed to operate in confined spaces where floor-mounted equipment could not, the versatile Ski-Wracker (exclusive to KING) can stack up to 30 ft. high and take loads of 250 lbs—10,000 lbs. Swift, safe and easy to control, the KING Ski-Wracker is the perfect answer when storage space is at a premium. More and more warehouses and factories are installing this unique equipment to handle plastics, sheet metal, wire, scrap metal or tabulating machines. In the film, motor car and aircraft industries, the Ski-Wracker has proved indispensable.

UNITS AND OPTIONAL ATTACHMENTS TO SUIT INDIVIDUAL LOADS

KING

REGISTERED TRADE MARK

SKI-WRACKER

(Covered by British and Foreign Patents)

SEND FOR ILLUSTRATED LITERATURE TODAY

Fill in your name and address and post to us

NAME _____

ADDRESS _____

_____

GEO. W. KING LIMITED, S.31 ARGYLE WORKS, STEVENAGE, HERTS. TEL: STEVENAGE 440

the junior rotary cutter

This machine will meet all demands for a really robust yet small granulating machine with a high performance. The Junior is provided with a large granule collecting bin and the rotor is driven through V-belts by a 1 H.P. motor mounted on the framework. The machine is quiet in operation and has been designed to ensure easy cleaning and maintenance. If desired the unit can be supplied suitable for bench or mobile mounting. The Junior Rotary Cutter is produced by specialists in the cutting of plastics and is one of the range of well-known Masson Rotary Cutters. Please write for further details.

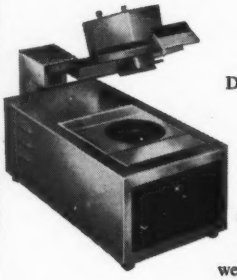
BLACKFRIARS ROTARY CUTTERS LTD.

Blackfriars House, New Bridge St., E.C.4

Telephone : FLEet Street 6383

BALDWIN DENSITOMETERS

These accurate electronic instruments, used with the Baldwin Photometer, measure or compare light intensity and density and colour of a wide variety of solids and liquids. Baldwin Densitometers set high standards in accuracy and ease of operation and have innumerable uses in industry, research and photography —write for a copy of Brochure L-117 which gives complete information on the entire range.

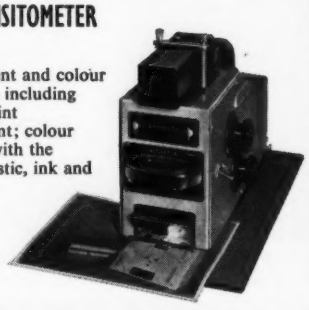


TRANSMISSION DENSITOMETER

Density measurement and colour analysis of all transparent and translucent materials including black and white film and paper, positive and negative colour film; opacity measurement of glass, plastics, resins; chromatogram analysis; colour filter transmission measurement and welding glass density measurement.

REFLECTION DENSITOMETER

Density measurement and colour analysis of surfaces including black and white print density measurement; colour print comparison with the original; paint, plastic, ink and textile colour measurement; reflectance values and colour analysis of tiles, ceramics and very fine powders.



BALDWIN scientific instruments

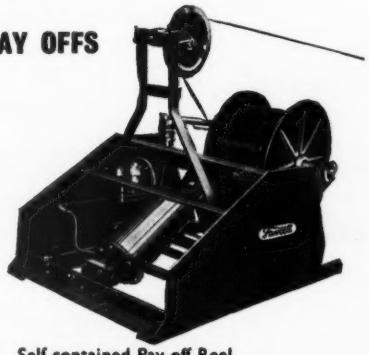
One of the Harper group of companies

BALDWIN INSTRUMENT COMPANY LIMITED

BROOKLANDS WORKS · DARTFORD · KENT Tel: Dartford 2948

B.65

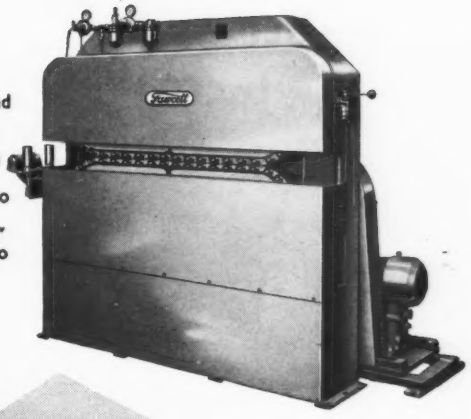
PAY OFFS



Self-contained Pay-off Reel Stands available for reels from 16″ to 96″ flange diameter.

DAVIS-STANDARD CATERPILLAR HAUL-OFF

Designed for high speed and efficiency. Available with pulling capacities up to 5,000 lbs. with pressure on self-centring articulated treads variable from zero to 400 lbs.
To handle material up to 5″ dia. at variable speeds up to 300 ft./min. with perfect co-ordination between caterpillar and extruder drives.



Fawcett

...foremost for Plastics and Rubber Equipment

offer these IMPORTANT SERVICES

- Complete automatic cable covering installations for Rubber and Plastics.
- Extrusion lines for plastic sheeting, tubing and blown film with all ancillaries.
- Free Customer technical advisory service and information.
- Installation and commissioning trials to customers' requirements.

DAVIS-STANDARD EXTRUDERS From 2½″ to 6″

Sectioned steel cylinders with Xalloy liners. Therma-Fin patented zonal heaters with individual control for air cooling. Non-pulsating stock screw rotation from special worm drive. Hinged, quick opening clamp type heads. All rotating parts continuously lubricated from common sump.

TAKE-UPS

Both single and dual take-ups are available for reels up to 96″ diameter. Dual take-up operation is continuous and automatic, including transfer of wire from reel to reel with pneumatic raising and lowering and automatic braking. The operator only needs to replace full reels with empty ones.

FAWCETT PRESTON & CO. LTD.
(Incorporating FINNEY PRESSES)
BROMBOROUGH · CHESHIRE
Phone : Rock Ferry 2201. Grams : " Fawcett Bromborough "
A member of the Metal Industries Group of Companies

FF/161

No Sticking, No Staining, and Increased Durability with Hard Chromium Deposition

by ARMOURCHROME

Armourchromed rolls used on a pilot plant processing amino-plastic moulding powder in the factory of British Industrial Plastics Limited, Oldbury.

Armourchromed rolls eliminate sticking and staining and provide a smooth, perfect finish. The hard, non-porous surface of Armourchrome prevents the permeation of oxides from the basic metal and increases working life several times. Delicate pastel-coloured powders may be entrusted to Armourchrome with full confidence. Write to our Technical Sales Department for full details.

THE BRIGHTSIDE PLATING CO. LTD.

BREARLEY STREET · BIRMINGHAM · 19

Telephone: Aston Cross 2663-4

round the bend?

Don't let plastic extrusion problems get you down. By consulting us you can count on unbiased technical advice, unequalled production resources and ungrudging personal service.

P.V.C.–

- **RIGID & FLEXIBLE**
- **POLYTHENE**
- **ACETATE**
- **POLYSTYRENE**

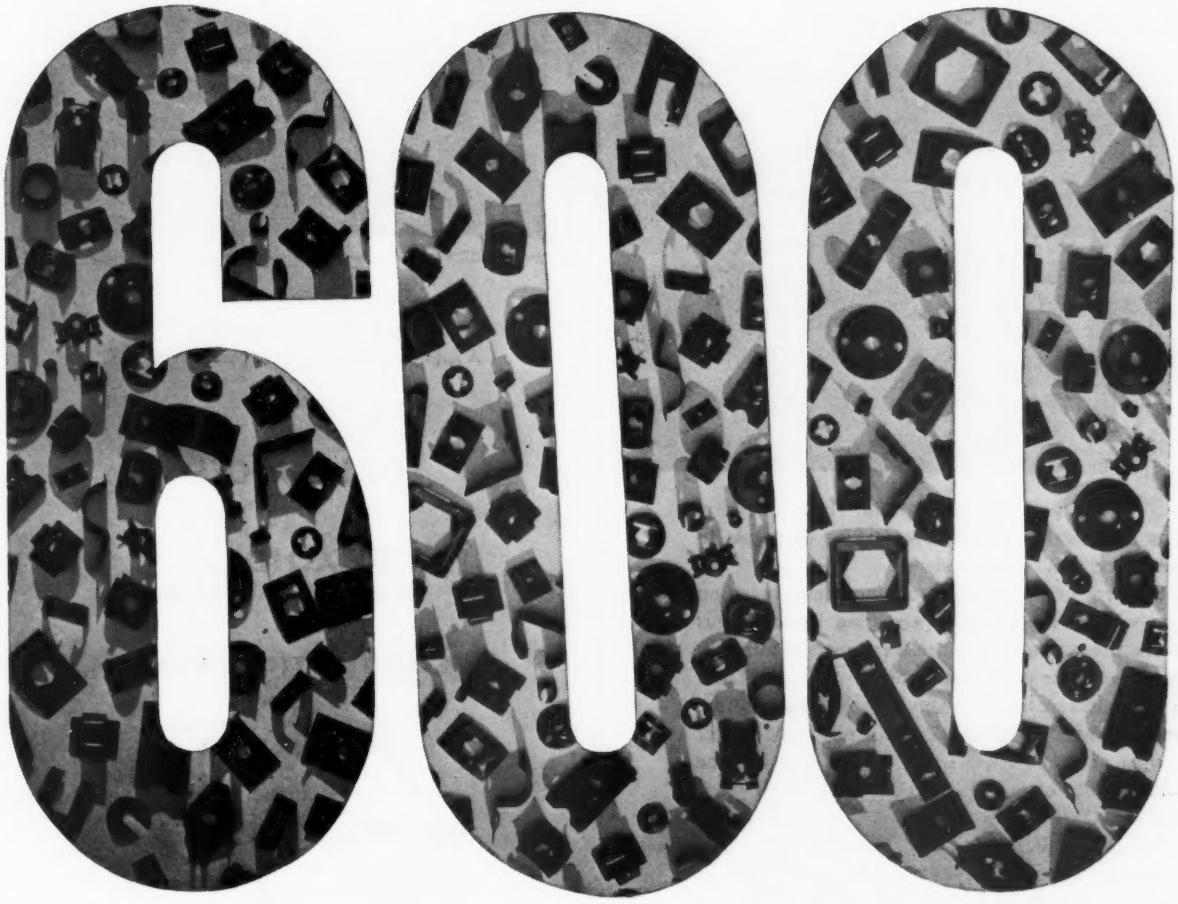
TUFFLEX

C. & C. MARSHALL LIMITED

1264 HIGH ROAD, WHETSTONE
LONDON, N.20

Telephone: Hillside 5041 (3 lines)
Telegrams: Tufflex, London, N.20 Cables: Tufflex, London

now over



Spire Speed Fastenings!

Whatever you make, you are pretty certain to be using Spire speed fasteners of one sort or another. But we want to remind you that there are now over 600 different types. Some of these may be new to you—one of them may be the answer to an assembly problem that you hadn't associated with Spire fastenings. We are always happy to examine your product and make specific recommendations.

Call in our Technical Representative—he's a fastening expert.

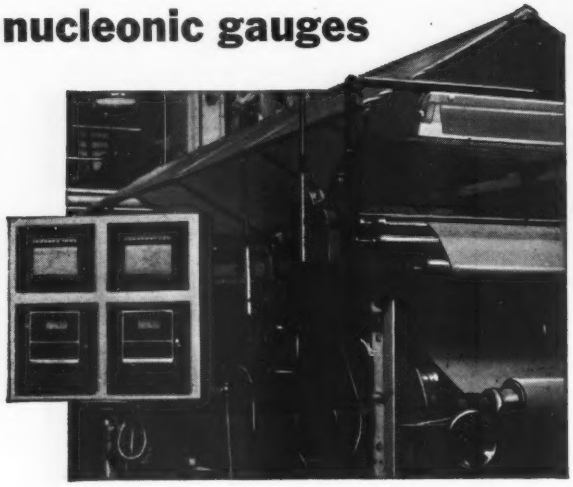
Enquiries to: **SIMMONDS AEROCESSORIES LIMITED**
SPIRE SPEED NUT DIVISION,
11a ALBEMARLE STREET, LONDON, W.1.
Tel: HYDe Park 5741/2.
Head Office & Works: TREFOREST, PONTYPRIDD, GLAMORGAN.
Branches: Birmingham, Manchester, Glasgow, Stockholm, Copenhagen, Ballarat, Sydney, Johannesburg, Naarden, Milan and New York.

A MEMBER OF THE FIRTH CLEVELAND GROUP

FC

CRC 525

I.C.I. installs EKCO non-contact nucleonic gauges



I.C.I. Leathercloth Division, Hyde, Cheshire, has installed Ekco Nucleonic Gauges as an aid to improved production efficiency.

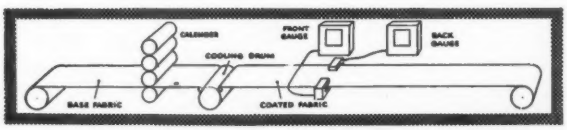
They provide an accurate running commentary on the web during process, permitting instantaneous corrective action to be taken. Permanent records are provided by the associated continuous recorder. These gauges measure the weight of the running sheet before reeling. This facilitates rapid attainment of the correct weight at the commencement of each run and the maintenance of the specification weight throughout the run. Quality is enhanced and wasteful variations of weight significantly reduced.

The equipment is designed for the easy addition of ancillary units for automatic control of the calender screwdown.

We shall be pleased to send you further details of Ekco Nucleonic Gauges, or one of our Technical Representatives will be glad to call and discuss your needs.

the EKCO nucleonic gauge

can step-up the efficiency of **your plant**



EKCO ELECTRONICS LTD

EKCO WORKS • SOUTHEND-ON-SEA • ESSEX • SOUTHEND 49491

MILTOID SALES DIVISION

BX PLASTICS LTD.
A Subsidiary of the British Xylonite Co., Ltd.,

FOR

CELLULOID

BEXOID REGD.
CELLULOSE ACETATE

BEXOID OPTICAL SHEET

BEXOID FILM

BX POLYSTYRENE

COBEX REGD.
RIGID VINYL SHEET

VELBEX REGD.
FLEXIBLE VINYL

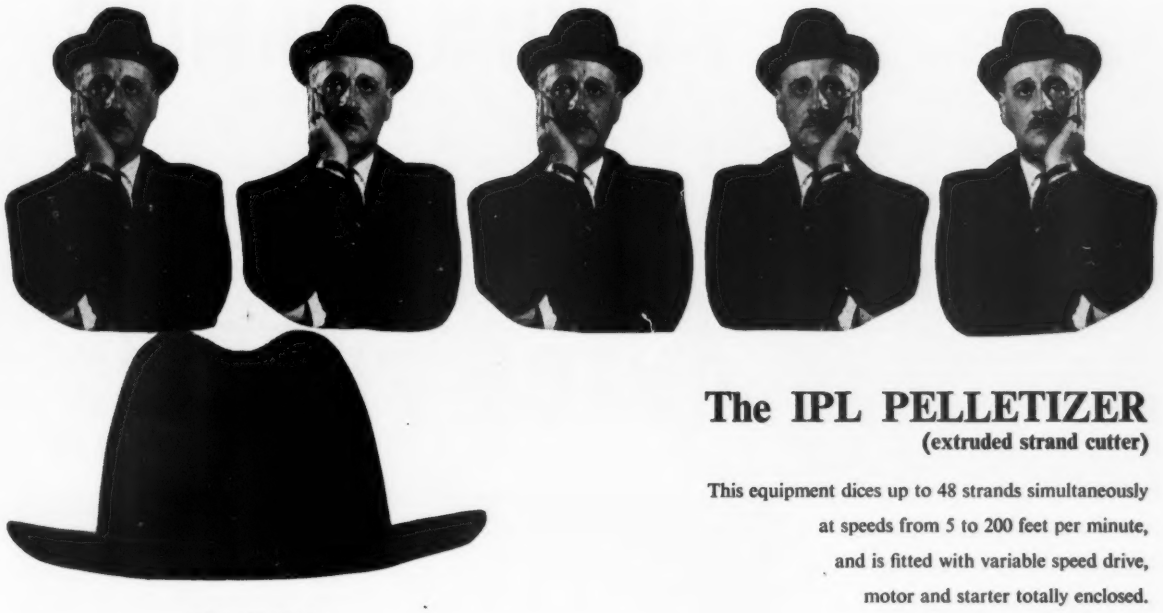
In clear transparent and industrial black sheet, Velbex P.V.C. transparent beverage hose and industrial hose

LAMPSHADE SHEET
IN BEXOID AND COBEX

AKULON (Nylon) RODS
Sole Distributors for the British Isles

34/36 ROYAL COLLEGE STREET · LONDON, N.W.1
PHONE EUSTON 4146/7 GRAMS: CELUDOL, NORWEST LONDON

T.A.10334



The IPL PELLETIZER
(extruded strand cutter)

This equipment dices up to 48 strands simultaneously at speeds from 5 to 200 feet per minute, and is fitted with variable speed drive, motor and starter totally enclosed.

For demonstration of Pelletizers, Girovinyle Cube Dicers and Condux Cutting Mills please apply to 93 Regent Street

YOU, too, can see 24 plastic strands being diced together

at 93 Harrow Road, London W 2

INDUSTRIAL PLASTICS LTD

IPL

93 Regent Street, London W1 *Telephone:* REGent 3146/9 *Cables:* Ipla London *Machinery Showrooms:* 93 Harrow Road, London W2

Razor Pack (Cellulose Acetate)

VACUUM FORMING

THE ESTABLISHED PLASTICS PROCESS FOR

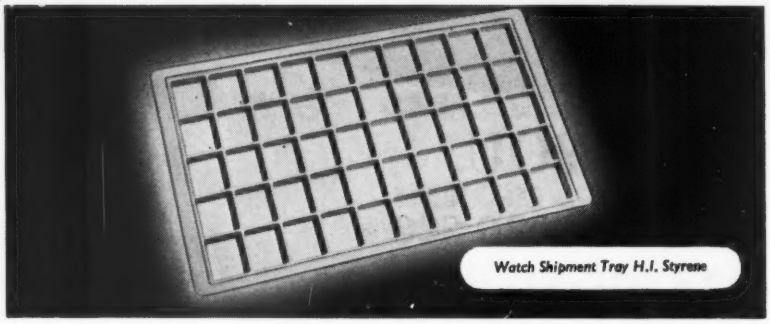
★ LONG OR SHORT RUNS
★ LOW TOOLING COSTS
★ LARGE INTRICATE SHAPES OR SMALL COMPONENT PARTS, PRE-PRINTED IF REQUIRED
★ PACKAGING; ASSEMBLY TRAYS & CONVEYOR BUCKETS; ENGINEERING AND INSULATING COMPONENTS; ADVERTISING DISPLAYS; FANCY GOODS; FURNITURE FITMENTS—from RIGID & FLEXIBLE P.V.C., CELLULOSE ACETATE, HIGH-IMPACT POLYSTYRENE, POLYTHENE —in GAUGES from .005 in. to ¼ in. THICKNESS
★ TRADE WORK WITH CONFIDENCE AND SECURITY

OMEGA PLASTICS LTD

Consult the original Pioneers and Specialists in Vacuum Forming

OMEGA PLASTICS

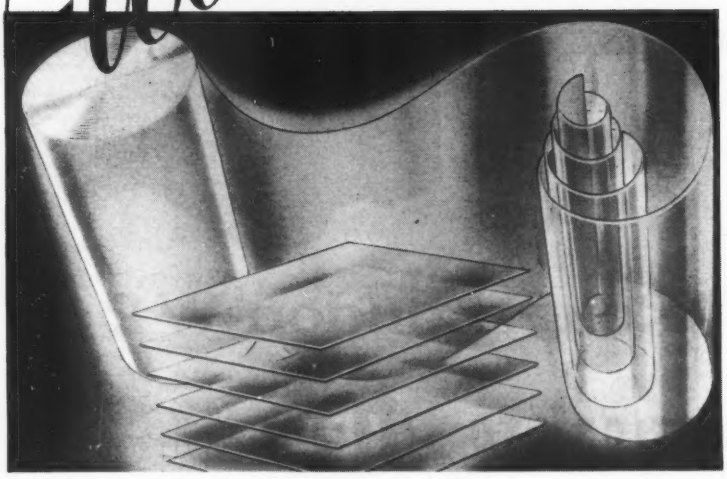
TELEPHONE:
RIP 3521/2
HIGH BRIDGE ROAD
BARKING, ESSEX


Watch Shipment Tray H.I. Styrene

(1933-1958)

Utilex

CELLULOSE ACETATE
sheets and films
SUITABLE FOR VACUUM FORMING



CLEAR TRANSPARENT
pol/pol or matt/pol

COLOURED TRANSPARENT
tinted

LAMPSHADE MATERIAL
matt or embossed

COLOURED OPAQUE
pol/pol or matt/pol

METALLISED
mirror-finished in silver and colours

INSULATING
dielectric qualities

UTILEX LIMITED *MILL STREET, KINGSTON-ON-THAMES. Telephone: KINGSTON 1660*

'off the shelf' control systems

for temperature and pressure

Easy to get . . . easy to install . . . a new range of *standard* controllers is now available from Honeywell. These low cost on-off and modulating (potentiometer type) controllers bring increased economy, efficiency, safety to an unlimited number of relatively simple processes. They operate line or low voltage electric switching, magnetic valves, and Honeywell 2-position and modulating motors.

Between 0 and 300 psi—Honeywell Pressure Controllers directly control boilers, retorts, combustion systems, pneumatic and hydraulic servo loops . . . actuate safety devices . . . control liquid level.

From 0 to 700°F—Honeywell Remote Bulb Thermostats offer a liquid fill controller that does not age. They exert precise control on temperatures in ducts, pipes, tanks, boilers and other heat exchangers.

Ruggedly constructed, Pressure Controllers and Remote Bulb Thermostats survive the most stringent operating conditions. Special production planning will maintain ex-stock availability.

Honeywell

H HONEYWELL *First in Control*

Honeywell Controls Ltd, Ruislip Road East, Greenford, Middlesex. Waxlow 2333

WRITE OR SEND THE COUPON TODAY P

Please send me literature on Honeywell Temperature and Pressure Controllers

NAME.....

POSITION.....

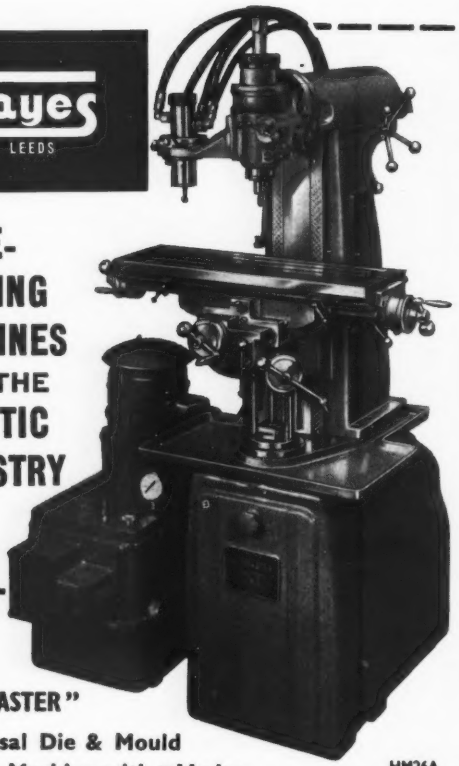
ADDRESS.....

.....

Expert advice and assistance available from offices in the principal cities of the United Kingdom and throughout the world.

Hayes LEEDS

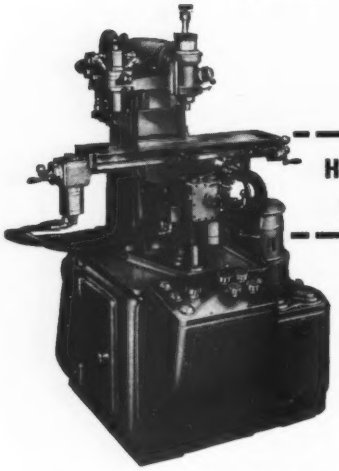
DIE-SINKING MACHINES FOR THE PLASTIC INDUSTRY



"DIEMASTER"

Universal Die & Mould Milling Machine with "Hydro-tracer" Copying attachment

	HMH21A Standard Machine	HM26A with Hydro-tracer
Table Size	21" x 6½"	26" x 8½"
Longitudinal Traverse ...	12"	13"
Transverse Traverse ...	5"	5"
Vertical Traverse ...	12"	12"
Overarm Traverse ...	7"	7"
Working Area	10½" x 12"	10½" x 13"
Spindle Speeds	50-2, 400 r.p.m.	



HIGH-SPEED HEADS

1,000 — 6,000 R.P.M.

"TRACEMASTER"

Automatic Copy Milling

	TM32a
Table Size	32" x 8½"
Longitudinal Traverse ...	16"
Transverse Traverse	8"
Overarm Traverse	7"
Working Area...	11" x 16"
Vertical Hand Traverse ...	9½"
Vertical Hydraulic Traverse ...	3½"
Spindle Speeds ...	50-2, 400 r.p.m.

Sole Selling Agents for Home and Overseas :

ASSOCIATED BRITISH MACHINE TOOL MAKERS LTD.

17 Grosvenor Gardens, London, S.W.1

HAYES ENGINEERS (LEEDS) LTD.

GELDERD ROAD, LEEDS 12.

Tel.: 38941. 'Grams.: "Toolmaker" Leeds 12.

Extruded Plastics!

Specialists in Flexibles

Extensively used in Packaging, Cosmetics and the Motor, Electronics and Radio Industries.
P.V.C. sleevings .010–2 in. Bore, Pipings and Sections
Polythene Tubes to fine limits, Cable and Wire Rope covering.

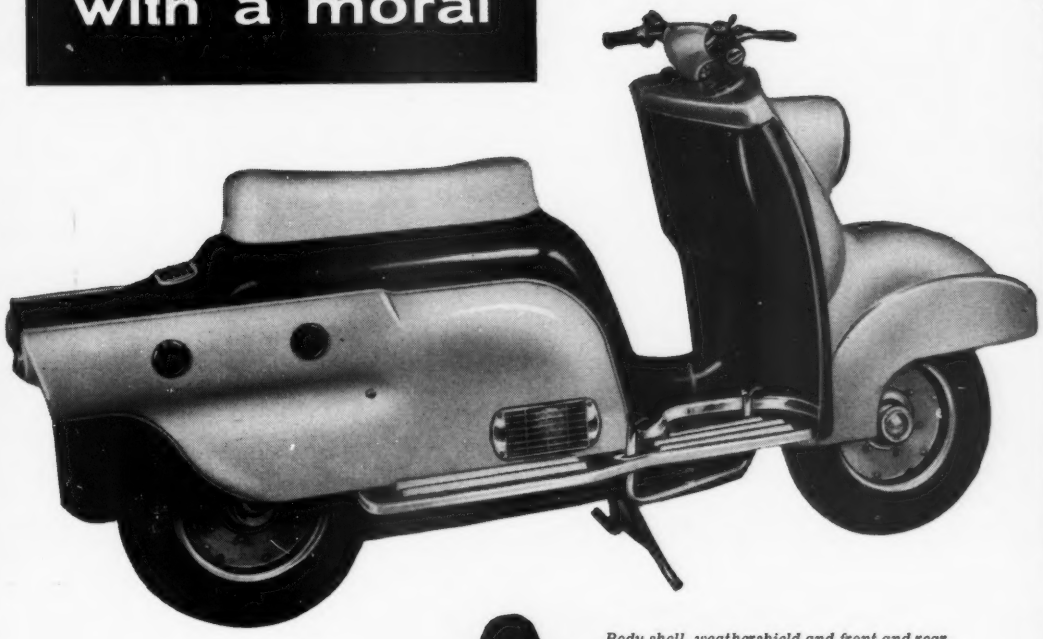
Brown, Davidson and Company Limited

Banchory Works, Hartley Wintney, Nr. Basingstoke, Hants

Telephone: Hartley Wintney 302.

Telegrams and Cables: Kilty, Hartley Wintney.

SCOOTER with a moral



Body shell, weathershield and front and rear mudguards, side panels, head-lamp cowling, dash board, foot boards and petrol tank of the Bond Scooter are all in F.R.P. Manufacturers and moulders: Sharp's Commercial Ltd., Preston.

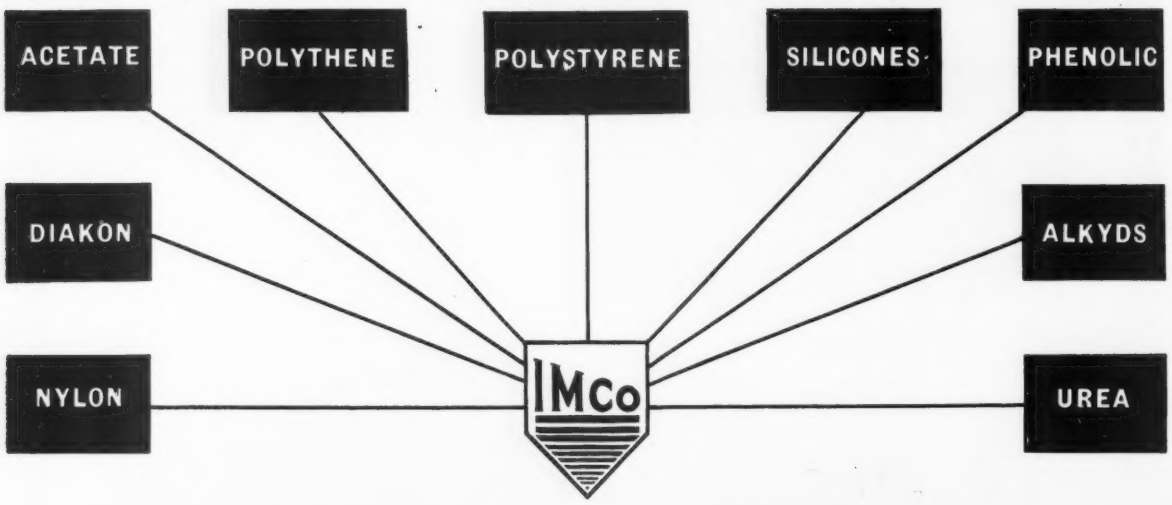
The Bond Scooter has a body of Fibreglass Reinforced Plastic because — and we quote — "it enables us to save 40 lb. in weight and this gives a consequent increase in performance". To this we would add that bodies in F.R.P. are easily moulded into complex shapes without expensive equipment; that they will not dent, drum or corrode. The moral here is that what applies to scooters applies just as forcibly to cars and vans, trucks and pantechnicons. All can benefit from the lightness, toughness and malleability of F.R.P. Why, then, aren't more vehicle manufacturers using it? The short answer is that they are!

FIBREGLASS TRADE MARK

the backbone of reinforced plastics

Our F.R.P. advisory service is expert, confidential and free.

We are specialists in the moulding of all these materials



A.I.D. APPROVED. CONTRACTORS TO GOVERNMENT DEPTS.

INSULATION MFG. CO. (PLASTICS) LTD.

IMCO WORKS, GEORGE ST., GLASTONBURY, SOMERSET

Phone and Grams: GLASTONBURY 2258

Matched to your requirements

For screening, sorting or sifting heavy minerals or fine powders.
For filtering and processing liquids and semi-solids.
For restricting access and providing protection.
For improving presentation, the ornamental patterns add style and dignity to industrial design.

Please ask for Catalogue No. PS 858

'Harco' Woven Wire

Harvey

G. A. HARVEY & CO. (LONDON) LTD.
WOOLWICH ROAD, LONDON, S.E.7
Telephone : GREenwich 3232 (22 lines)

if you want...

LOW COST STEAM

Top efficiency with automatic modulating controls.

DEPENDABILITY

Proved by years of rugged service on diesel locomotives, ships, construction jobs . . . in all types of industrial applications throughout the world.

INSTANT STEAM

Full operating pressure in less than two minutes from a cold start.

HIGH PRESSURE STEAM

Standard models to 300 lb. p.s.i.

STONE-VAPOR STEAM GENERATORS

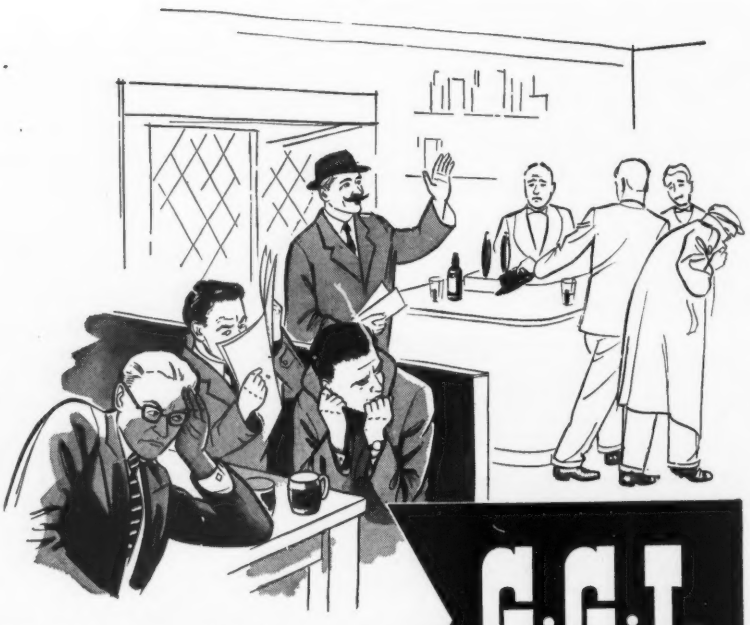
bring all these answers (and many more!) to your heating, power and processing problems. Allow us to help you choose the Stone-Vapor Steam Generator that is best suited to your requirements.

J. STONE & CO (DEPTFORD) LIMITED

LONDON S.E.14 (TIDEWAY 1202)

—manufacturing under licence of Vapor International Corporation Ltd., Chicago, U.S.A.

We all know this man. He's the chap who has just tried GGL for the first time and can't stop talking about the wonderful quality and service. He's a nice man, really, but he does go on . . . and it isn't as if we old stagers didn't rely on GGL service, too.



CAPSTAN AND AUTOMATIC WORK AND SHEET METAL PRESSING IN ANY METAL, ANY FINISH, ANY QUANTITY

FOR QUICK SERVICE AT THE RIGHT PRICE GET IN TOUCH WITH :

GRIFFITHS, GILBART, LLOYD & COMPANY LTD.
Empire Works, Park Road, Birmingham, 18
Telephone : Northern 6221

G·G·L

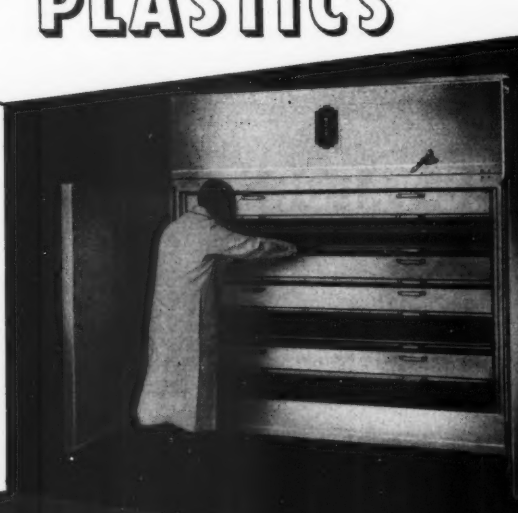
Funditor Industrial *Electric* ovens for PLASTICS

FUNDITOR ovens are supplied with either forced air circulation, or as natural convection ovens with temperature ranges up to 350°C. and 450°C, respectively.

Widely used in the PLASTICS industry, FUNDITOR ovens combine rapid and uniform heat distribution with automatic temperature control which ensures that a pre-set temperature be accurately maintained—an important factor when pre-heating plastic moulding powder or curing finished articles.

Although our range of standard ovens is very wide, we are always pleased to supply 'specials' to meet requirements.

Send for illustrated leaflet.



DRYING
CURING
SOFTENING
AGEING
PRE-HEATING

Funditor

NYPEN
Regd. Trade Mark

NYLON MOULDINGS

This tough, lightweight material is being used increasingly for Gears, Bearings, Washers, Gear Blanks, Rollers, Valve Seats, Coil Formers, etc. Take advantage of our specialised knowledge and long experience of this exceptional material. We also produce millions of injection mouldings in Polystyrene, Diakon, Cellulose Acetate, etc.

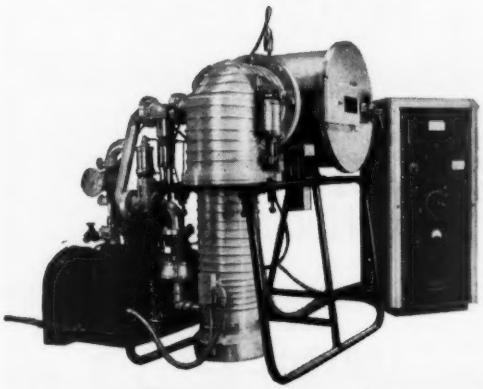
PENDRY (PLASTICS) LTD.

BRIDGE WORKS, BRENTFIELD RD.
WILLESDEN, LONDON, N.W.10
Phone ELGAR 7932-3
A.I.D. Approved

HIGH VACUUM COATING UNIT

EH24 Mk III

The VIA-VAC EH24 Mk III Coating Unit substantially widens the industrial applications of the High Vacuum Evaporation process. Its design is sufficiently flexible to allow for great variety of articles to be accommodated. It combines fast process cycles with simplicity and safety of operation and ensures highest quality of deposited film.



- **OPTICAL APPLICATIONS.**
  Anti-Reflection Coatings.
  Multi-Layer Interference Filters.
  Front Surface Reflecting Mirrors.
  Semi-transparent Coatings.
  Beam Splitters.
  Motor Car Lamp Reflectors.
  Torch Reflectors on metallic and plastic Bases.
- **ELECTRICAL APPLICATIONS.**
  Insulating Layers on conducting surfaces.
  Conducting Layers on non-conducting surfaces, e.g. Printed Circuits, Resistors Capacitors.
- **COMMERCIAL APPLICATIONS.**
  Three Dimensional Metallised Transparent plastics like car accessories and fittings, e.g. hornbuttons, nameplates.
  Deposition of decorative metallic films on external surfaces of plastic and metal articles such as toys, costume jewellery, ornaments, etc.

HIGH VACUUM CONSULTING
VIA-VAC
SERVICE TO INDUSTRY

VACUUM INDUSTRIAL APPLICATIONS LTD. (Dept. P), WISHAW, LANARKSHIRE, SCOTLAND
Telephone: WISHAW 142 Telegrams: "VIA-VAC, WISHAW"

M

A practical textbook on plastics

THE PROPERTIES AND TESTING OF PLASTICS MATERIALS

By A. E. Lever and J. Rhys

This book, the first of its kind, is a reference work for those engaged in the testing of plastics and contains comparative technical information, much of it in readily understandable tabulated form, on a wide variety of materials employed in plastics manufacture.

The authors have had considerable experience in plastics, and have here collated in a convenient form all available information on the physical and chemical properties and methods of testing plastics.

Containing over 1,600 references, a comprehensive glossary of reference abbreviations and an extensive index, this volume will prove invaluable to research workers, development staffs, inventors and students in the plastics and associated industries. At the same time it will serve as a standard work of reference to all who manipulate or use plastics materials, containing as it does complete material specifications.

Royal 8vo. Cloth Boards 30/– net. (By post 31/2)

Obtainable from Booksellers or direct from the Publishers

TEMPLE PRESS LIMITED · BOWLING GREEN LANE · LONDON E.C.1

A NEW IDEA

FAST, EASY AND ECONOMICAL TO USE

PRECISION Banc-Lok SELF-LOCKING INSERTS

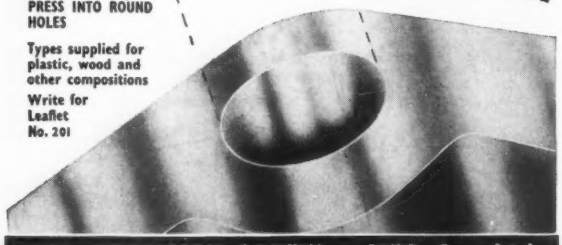
★ THE INSERT THAT IS PUSHED IN AFTER MOULDING

★ PROVIDE RE-USEABLE SELF LOCKING THREADS IN BLIND HOLES

★ NO SPECIAL TOOLS NECESSARY . . JUST PRESS INTO ROUND HOLES

Types supplied for plastic, wood and other compositions

Write for Leaflet No. 201



THE PRECISION SCREW & MFG Co. Ltd.
UNION STREET · WILLENHALL · STAFFS
TELEPHONE: WILLENHALL 621 & 622

LIVERPOOL
REGENT ROAD
BOOTLE 20
(BOOTLE 4621/8)

MANCHESTER
BARTON DOCK ROAD
URMSTON
(URMSTON 2205)

BULK HAULAGE
OF ALL TYPES OF
LIQUIDS
& POWDERS
ALSO TANK & HOPPER VEHICLES ON CONTRACT HIRE

PICKFORDS
TANK HAULAGE SERVICE

MARSHGATE LANE
STRATFORD
LONDON, E.15
(MARYLAND 3064/7)

A new and comprehensive range of Plastic Extrusions

To meet a growing demand, both at home and abroad, for "Melplas" extruded plastics we have increased our range of sections for use with ⅛ in. hardboard and laminate plastic sheets. These sections, some of which we introduced as long as ten years ago, cover most of the requirements of the manufacturer and "do-it-yourself" user. The folder reproduced above, copies of which are available on request, illustrate this range in actual sizes.

WRITE TO US FOR THIS ILLUSTRATED FOLDER.

EXTRUDED THERMOPLASTICS IN RIGID & FLEXIBLE P.V.C., CELLULOSE ACETATE & POLYTHENE

MELWOOD THERMOPLASTICS LTD

WILLOUGHBY ROAD, HARPENDEN, HERTS. TEL. HARPENDEN 300 & 311

LONDON OFFICE: 49 LONDON WALL, E.C.2. TEL. MONARCH 6862

MELPLAS EXTRUSIONS

Orthopaedic Hospitals use G.E.C. INFRA-RED plant for softening thermoplastic sheet

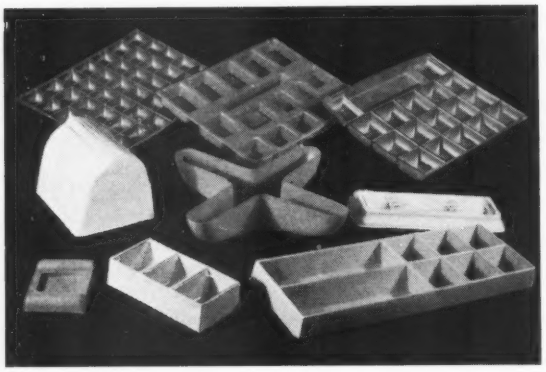
G.E.C. infra-red plant is helping orthopaedic hospitals to produce plastic supports and appliances which are less cumbersome and more hygienic, cheaper and easier to make than leather and steel ones. The thermoplastic sheets are softened for shaping rapidly and uniformly without marking or contamination. Plant for softening thermoplastic sheet is only one item of the wide range of G.E.C. process heating equipment.

Polythene and polyurethane foam are used together in the making of splints, spinal jackets, etc. We show the thermoplastic sheets being placed in the G.E.C. lamp plant for softening.

for efficient process heating

use G.E.C. FURNACES · HIGH FREQUENCY · INFRA-RED

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2



Vacuum Forming . . .

If you will let us have any plastic fabricating problems you need resolving we shall be very pleased to offer our expert advice

Vacuum Forming is another service offered by Tensile Products Ltd., in addition to General Plastics Fabrication. With this process an infinite variety of shapes can be produced economically in High Impact Polystyrene, Cellulose Acetate, etc., for such purposes as Packaging, Display, Signs, Interior Fittings for Cabinets, etc.

TENSILE PRODUCTS LTD.

WILLOUGHBY RD., HARPENDEN, HERTS. TEL. HARPENDEN 3515

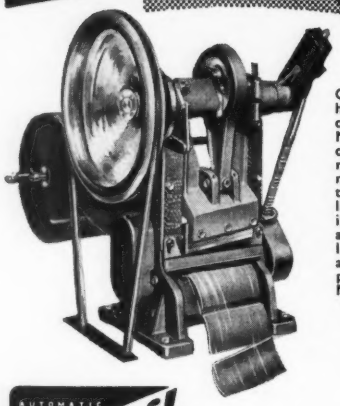
HARD CHROME PLATING

- Mirror finish on Dies, Moulds, and Tools for Plastic and Rubber Industries
- For Wear and Reclamation on Worn Machine Parts and Machine Tools
- **General Metal Workers, and Engineers**
- Trade Electro-Platers and Enamellers for all Metal Finishes
- Guaranteed Quality Work
- Collection London District

THE ISLINGTON
METAL & PLATING WORKS LTD.
TORRENS WORKS
TORRENS ST. (ANGEL) LONDON, E.C.1
TELEPHONE: TERMINUS 9621 (5 LINES)
A.I.D., A.R.B. A.R.D.E. APPROVED

HEAVY CHROME DEPOSITIONS

An Autogil's accuracy is on the level!



Cutting roll or strip material by hand is a waste of time when you can use an "Autogil" guillotine. No more squaring-up, marking, and cutting individual pieces—it's a matter of moments to set the measure-control, apply the material to the rollers and as soon as you like 120 pieces a minute are streaming from the machine. So truly cut and uniform in size that you can lay a spirit level across the edges of any batch and prove an Autogil's precision for yourself.
Meanwhile, send us a sample of felt, insulating material, rubber (*sponge included*), textile fabric, plastic film, foil, fibre, mica, paper, wire or thin sheet metal and we will gladly return the sample pieces cut to the size you specify.

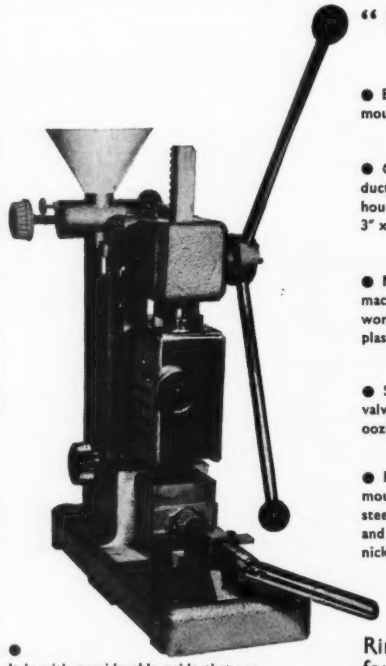
AUTOMATIC Autogil REGD. TRADE MARK GUILLOTINES

write to Dept. A14, too, for details of our new tube-cutting attachment It cuts 240 pieces of tube or rod up to ½" o.d. per minute.

WALLIS ENGINEERING COMPANY
Telephone: Acocks Green 4766
399 WARWICK ROAD BIRMINGHAM 11

Telegraphic Address: Autogil Birmingham 11

"PEPCO"



- Bench-type injection moulding machine.
- Capacity ¼ oz. Production rate 120 per hour. Mould dimensions: 3" x 3" x 2".
- Most versatile machine suitable for working all thermoplastics including *nylon*.
- Special "non-drip" valve fitted, preventing oozing from the nozzle.
- Most comprehensive mould service in stainless steel, nickel chrome steel and electro-formed hard nickel tools.

It is with considerable pride that we present our new model—an efficient bench-type machine which provides the answer to many day-to-day problems in industry.
The simplicity of operation, coupled with the low cost of moulds, makes this the most versatile machine of its kind on the market.

Ring TER 9648 for particulars

Manufactured by

PEPCO LTD.
21, SKINNER ST., E.C.1

"There's no home here for us . . ."

. . . is an oft heard remark made by London mice as they look for rooms to let. You see, every inch of space at the Michael S Stevens factory is filled with Plastic Scrap. Michael S Stevens Ltd. is the most reliable contractor for the collection and disposal of Thermo-Plastic Scrap in all its forms. The factory at Hammersmith is one of the largest of its kind, helping the company to provide an unrivalled service to buyers and sellers alike. Why not ring them yourself? They will be able to help you in the purchase of any scrap you may need and offer you the best price for scrap you may have for disposal.

PLASTIC SCRAP
Michael S. Stevens Ltd

50 RAVENSCOURT GARDENS
LONDON W.6
Telephone: RIVerside 8906-7-8

BAND & CARTRIDGE HEATERS

for the
PLASTICS INDUSTRY

MICA-WOUND BAND HEATERS MADE FROM BEST QUALITY MATERIALS. SUITABLE FOR EXTRUDERS, DIES, BARRELS AND MOULDING PRESSES. LAGGING CASES ASBESTOS MATTRESS FILLED. OUR ENGINEERS WILL DISCUSS YOUR PROBLEMS ON SITE.

PHONE 52148 GENRISTO LTD. OSMASTON ST. NOTTINGHAM

For domestic and industrial flooring

PHENCO

The modern flexible Vinyl-Plastic Flooring

For the cable industry

PHENWRAP

Dielectric and Sheathing Compounds, wrappings and sheetings of various thicknesses and colours

MOULDING POWDERS

Polyethylene and Polystyrene

Write for full details of the complete range

PHOENIX RUBBER CO. LTD.

Works: 2K, Buckingham Avenue, Trading Estate, Slough
Telephone: Slough 22307/9

Elm Plastics LIMITED

Plastic Goods Manufacturers,
Solely to the trade, Tool Designers,
Toolmakers, Injection Moulders, Slush
Moulders, Vinyl Rotation casting,
vacuum forming, plastic coating and assemblers.
Styrene Cellulose Acetate, soft, semi-rigid and
rigid P.V.C., Alkathene and Diakon.
Nylon.

Elm Plastics Limited

RAINHAM, KENT

'Phone: Rainham, Kent, 81447

WHITE LEAD stabilisers

Consult
THE MERSEY
WHITE LEAD CO. LTD.
Sankey Bridges, Warrington
Telephone:
Warrington 30258/9

for your P.V.C. compounds

Prototype Machines

Special Purpose Parts

and Modifications

Telephone Euston 3176 — *Manufactured to order by Geo. Wailes and Company Limited* 382/388 *Euston Rd., London, NW1*

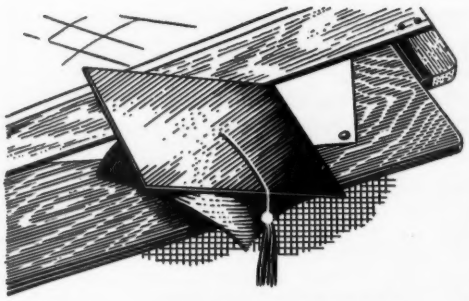
PERSPEX
Fabrications,
Mouldings,
Blowing, etc.
Specialists to the
Engineering &
Allied Trades.
Exterior, Interior,
& Illuminated
Signs.
Machine
Engraving.

Stockists of

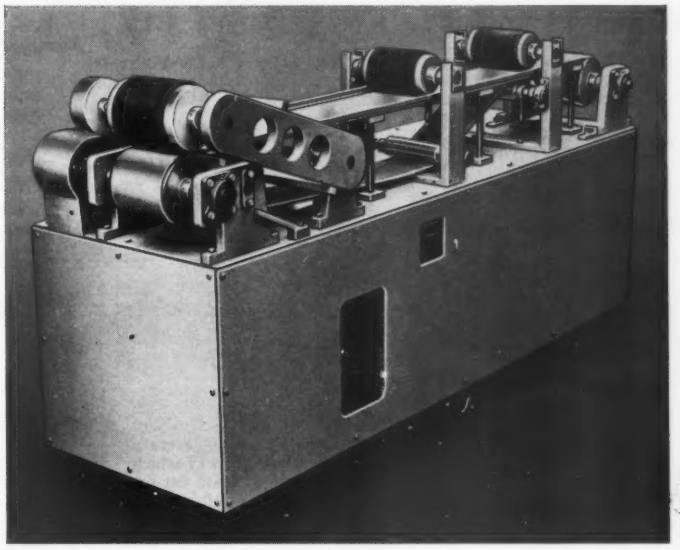
PERSPEX - DARVIC - COBEX
BEXOID - TRAFFOLYTE

Milton Engineering Co. Ltd

CLARENDON ROAD, **HYDE**, CHESHIRE. *Tel.* HYDE 2091



MASTERS OF DESIGN!



created exclusively for
MESSRS. MONSANTO CHEMICALS LTD.
with twin powered take-off pulleys

consult us for

- *HAUL-OFFS*
- *COILING GEAR*
- *ROVING SAWS*
- *LAY-FLATS*
- *CONVEYORS*
- *DIE HEADS AND EXTRUSION DIES*

designers and sole makers

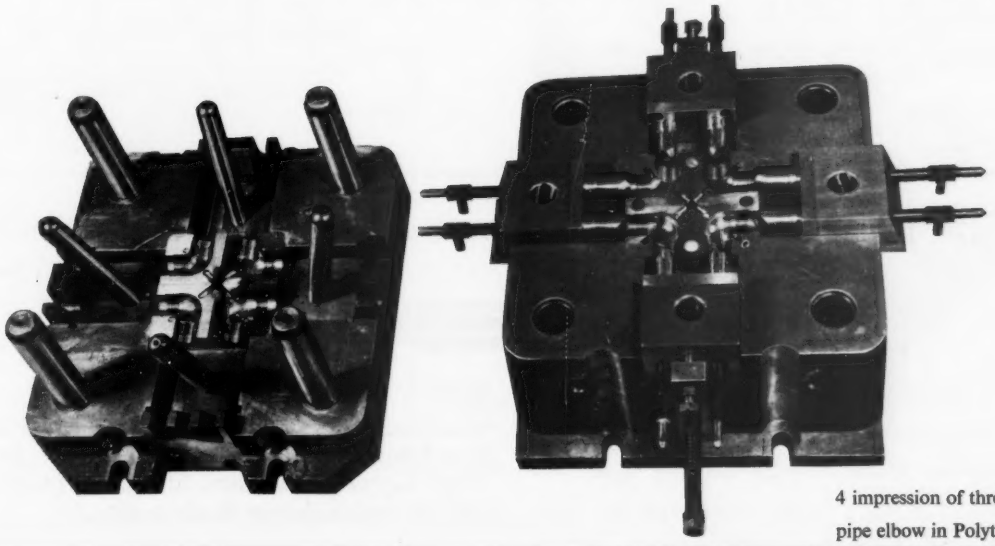
Grams: Jiggentool, Luton, Beds
Phone: Luton 6029

PIECE - PARTS & ASSEMBLIES
112 MIDLAND ROAD . LUTON BEDS

H. B. Sale Ltd *Makers of fine Moulding Tools*

Established 80 years
Member of G.T.M.A.

Progress Works, Summer Lane, Birmingham, 19
Telephone: Cen 5661-3 Telegrams: Sale, B'ham.



4 impression of threaded pipe elbow in Polythene.

LY-BAK LIMITED RUBBER & PLASTICS MANUFACTURERS

THERMOPLASTICS

Cellulose Acetate . Polythene . Polystyrene . Aceto-Butyrate P.V.C. and Co-polymer compounds . Polystyrene/Rubber compounds . "Semlux" Fibreglass products . "Plastiblox" Clicker and Rev Press Boards.

SOUTHERN INDUSTRIES AGENCY
(LONDON SALES OFFICE FOR THE GROUP)
SUITE 52 : 26, CHARING CROSS ROAD
LONDON, W.C.2. Telephone: Covent Garden 2538
" " " 1884

Virgin high acetyl and standard, cellulose acetate moulding powders. We are able to reprocess your redundant stocks and scrap into first-class moulding powders. We would be pleased to make you an offer for your scrap. Prompt deliveries of virgin and reconstituted powders.

LET US SOLVE YOUR MATERIAL PROBLEMS—THERMOPLASTICS IS OUR BUSINESS
"LY-BAK PRODUCTS ARE GUARANTEED TO SATISFY"
SAMPLES AND SERVICE AVAILABLE UPON YOUR INSTRUCTION

Factory efficiency
in your Library

Finished in full-bound leathercloth, with *Plastics* title on the spine, the Easibinder will hold up to six average copies of *Plastics* each of which can be opened out quite flat for easy reference. Flexible steel wires hold each copy securely and no tools are required for either inserting or removing individual issues of *Plastics* from the binder.

Price
13/6 Each
(plus postage)

ORDER FORM
for EASIBINDERS
To: TEMPLE PRESS LIMITED
Bowling Green Lane, London, E.C.1

Please supply.....Easibinder(s) for *Plastics*

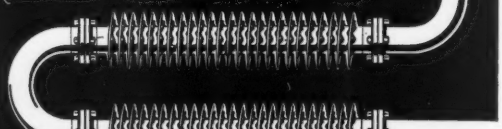
NAME.....

ADDRESS.....

.....

Remittance for.....enclosed.
(Postage on one folder 2s., on two 2s. 3d., on three 2s. 9d.)

HUNT



Gilled Tubes & Heaters
HUNT & MOSCROP LIMITED
P. O. Box No. 8 MIDDLETON MANCHESTER

dm HM27

PLASTICS

POLYTHENE, Polystyrene, Acetate and Perspex. We are sellers and buyers of these materials in any form.
GRANULATION and reprocessing plant available for:— Nylon, Cellulose Acetate, Polystyrene, Polythene and other Thermoplastic scrap. Materials ground to customers' requirements.

All enquiries to:—

John Castle & Co. Ltd.

5 HURLEY RD., LONDON, S.E.11
Phone: RELiance 4274/5

Scrolls for Plastic Extruders *made to any size constant or variable pitch*

JOHN DOCKER & CO. (ENGINEERS) LTD.
Cromwell Works, North Feltham Trading Estate, Feltham, Middlesex.
Telephone: Feltham 6341 Telegrams: Docrebuilt, Feltham Cables: Docrebuilt, London

also
Manufacturers of Spiral Marking Machines
Bunching machines up to 24" diameter, Bobbins
Paper lapping machines, Stranding machines
Pay-off and Take-up Stands, etc.

For the PLASTICS INDUSTRIES of the World

STEEL-SHAW *Jacketted* BALL MILLS *with porcelain linings*

Almost 40 years' manufacturing experience has resulted in many refinements and improvements; no other machine surpasses the Steel-Shaw Ball Mill in efficiency, for reducing materials to an impalpable powder. Its maintenance costs are extremely low and it requires only the minimum of attention in operation.

Steel-Shaw Mills can be supplied in various sizes and fitted with discharge casings and insulated cooling jackets, if required.

Why not send your samples of materials to our laboratory—we shall be pleased to offer our suggestions and recommendations without any obligation whatsoever.

There's a

STEEL-SHAW

answer to your problem . . . mixing . . . grinding or dispersion.

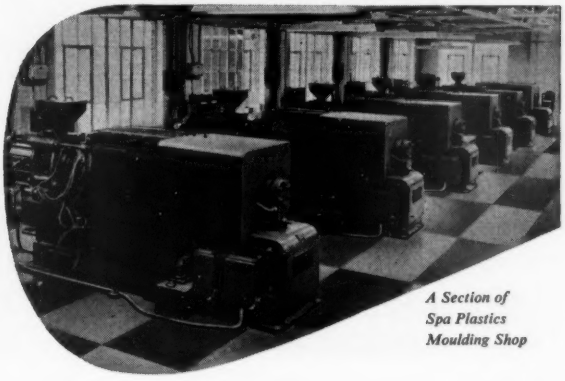
Write now for illustrated brochure to:

STEELE & COWLISHAW LTD. Dept. 27.

Head Office and Works, COOPER STREET, HANLEY, STOKE-ON-TRENT Tel. Stoke-on-Trent 23333 (5 lines); Telex 36-530. London Office, Westwood House, Swallow Street, Piccadilly, W.1.

Steel-Shaw Double Cone Blenders and Diamond Blenders rapidly and efficiently blend any free flowing solids. In sizes to suit every manufacturing requirement.

A MEMBER OF THE BAKER PERKINS GROUP



A Section of Spa Plastics Moulding Shop

Injection Moulders

to Customers Specifications

up to 32 ozs.

Enquiries Invited

Technical Advice Service Available

SPA PLASTICS (Division of Spa Brushes Ltd.)

Chesham, Buckinghamshire.

Telephone: Chesham 371 (P.B.X.)

AJAX

Air Turbine

HAND GRINDERS

FOR YOUR MOULDS

AJAX JUNIOR

Weighs only 8 oz. Speed approx. 90,000 R.P.M. For Grindstones $\frac{1}{16}$" to $\frac{1}{8}$" dia. Sturdy Spindle Collet bored for $\frac{1}{8}$" dia. shanks. Air Pressure required 50-100 lbs./sq. in.

Leaflets P2 and P3 on request.

Please state Air Pressure when ordering.

BRIGGS BROS (ENGINEERS) LTD

206 Edward Rd., Birmingham, 12

Calthorpe 2995

AJAX III

Powerful, yet easily handled. Speed approx. 50,000 R.P.M. For Grindstones $\frac{1}{8}$" to $\frac{1}{4}$" dia. Collet bored for 6 mm. or $\frac{1}{4}$" dia. shanks. Air Pressure required 50-100 lbs./sq. in.

Save Time & Make Money!

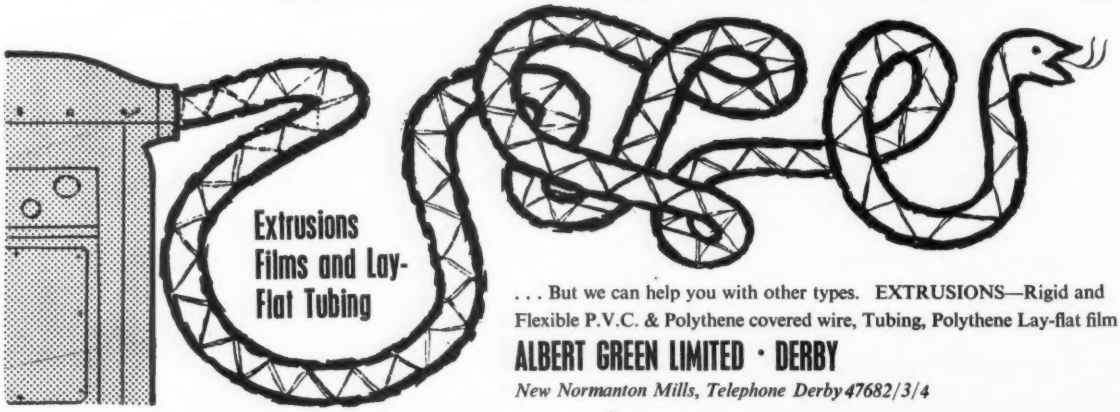
Ring **PARK 2681-2682** for all supplies of
Reprocessed, reground and scrap

POLYSTYRENE G.P & H.I
POLYTHENE, CELLULOSE-ACETATE & P.V.C.

Reprocessed, reground SCRAP—ALSO VIRGIN LOTS

WANTED—all thermoplastic scrap and redundant stock of same nature. Home and Export.
OVER 10 YEARS EXPERIENCE IN THE PLASTICS FIELD

VICTOR GRANT PLASTICS CO. LTD
67, WESTBOURNE GROVE, LONDON, W.2



. . . But we can help you with other types. EXTRUSIONS—Rigid and Flexible P.V.C. & Polythene covered wire, Tubing, Polythene Lay-flat film

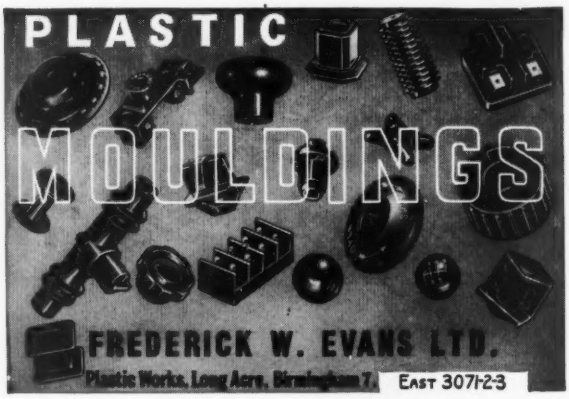
ALBERT GREEN LIMITED · DERBY
New Normanton Mills, Telephone Derby 47682/3/4

Wanted
STOCKS for CASH

We are cash buyers of merchandise of every description. Also Clearance Stocks. Discontinued Lines, Surplus and Redundant Stocks. Bottles, Jars, **Screw Caps, Cartons, and other Packaging Materials.** In fact, goods of all kinds can be disposed of through us without delay, on the most favourable terms, and without trouble.

Should you have anything for disposal either now or at any future time please send us samples, full particulars and price on a cash settlement basis and the matter will have our immediate and careful attention.

RELIANCE TRADING CO.
75, FAIRFAX ROAD, SWISS COTTAGE, LONDON, N.W.6
Phone: KILburn 0581 & 0038 *Grams:* "GORDON" KILBURN 0581



PLASTIC WELDING ELECTRODE CONSTRUCTION

made simple and economical by
METAL-WOODS precision brass rule

Available with plain and decorative faces, including the Metal-Woods 'CUT-SEAL' double faced rule for simultaneous welding and cutting

METAL-WOODS LTD., Market Harborough
'phone 2491 *'grams Metalwoods*

MANUFACTURERS OF A LARGE RANGE OF CADMIUM COLOURS

Where HEAT STABILITY, LIGHT FASTNESS and STRONG COLOURING POWER are of prime importance

USE PURE CADMIUM COLOURS

for the... PLASTICS INDUSTRY

Telephone BLETCHLEY 2526

METALIN *Limited of* BLETCHLEY·BUCKS.

JUSTOFLEX E.50
(EPOXIDISED SOYABEAN OIL)

JUSTOFLEX E.60
(EPOXIDISED COTTONSEED OIL)

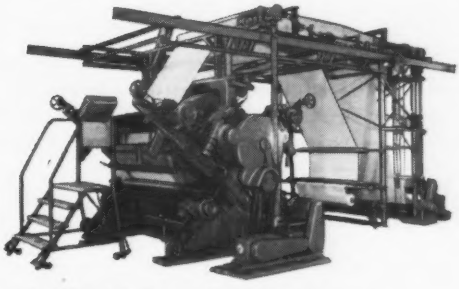
EPOXIDISED ESTERS

METALLIC LAURATES, RICINOLEATES, & STEARATES

LEAD PHOSPHITE DI-BASIC

ST JUST

THEODORE ST. JUST & COMPANY, LIMITED
WHITEFIELD, MANCHESTER, ENGLAND · Tel.: Whitefield 3211



New Olbrich Four-colour Rotogravure Printing Machine for Plastics

Very large printing drum ensures accurate maintonance of register.
Motorised register control for longitudinal and lateral adjustment of each colour from centralised control panel.
Hydraulic engagement and retraction of print nips.
Intermediate drying of each colour by gentle heating.
Printing rollers continue to revolve when web travel is stopped.

Machines for 1, 2 or 3 colours also available.
Printing, wipe-shading and lacquering machines for leathercloth.
Coating, spreading and gelling installations.
Embossing machines.

INTERNATIONAL CORPORATION LTD

Manufactured by Herbert Olbrich, Bocholt
International Corporation Ltd.
1 Cornwall Road, London S.E.1
Telephone: WATERLOO *3854*

SHEAR CUTTING MACHINES FOR PLASTICS, RUBBER, SPONGE AND FOAM RUBBER, ETC.

Model No. 1

HAND SHEAR CUTTING MACHINE

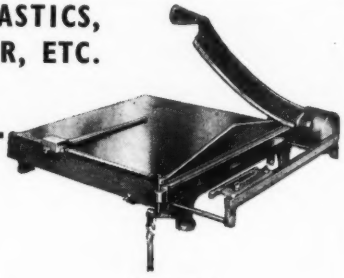
30", 43", 54" and 60" Length of cut.

T. KENDELL & SONS LTD.

Established 1840

French Place, Shoreditch, London, E.1, England

Many other machines and tools for your trade.



Model No. 6

BENCH HAND SHEAR CUTTING MACHINE

8", 12", 18" and 26" Length of cut.

D. NAPIER & SON LIMITED

LUTON AIRPORT

LUTON, BEDS.

A vacancy exists for a

TECHNICAL ASSISTANT

in the

PLASTICS LABORATORY

with experience in polymer and/or inorganic research.

He should be of degree standard. A.R.I.C. or equivalent qualifications. The successful applicant will be required to undertake research work on inorganic polymers.

Please write giving full details of experience and qualifications to **Dept. C.P.S. Marconi House, The Strand, London W.C.2.** quoting reference **P814G.**

Plastics technician

BRISTOL AIRCRAFT LIMITED need a plastics technician for their development department at Weston-super-Mare. Work will consist of:

1. Carrying jobs through from the design and tooling stage, from a technical standpoint. This will involve close liaison with the productive department concerned.
2. Assisting design and development work under the instruction of the plastics development engineer.

Applicants should be aged 25–35, must have technical school and ONC or Standard, and experience in reinforced plastics and engineering workshop practice. Grammar school education with GCE and HNC, and previous experience of the work involved, would be an advantage.

This position calls for self-reliance, tact, an analytical approach, and the ability to write comprehensive technical reports. The applicant may be required to exercise a certain degree of supervision.

If you are interested, write, giving details of age, qualifications and experience, to:

Personnel Manager, Room W/58JPL,
Bristol Aircraft Limited,
Weston Division, Oldmixon,
Weston-super-Mare

PLASTIC SCRAP BUYERS

POLYTHENE
POLYSTYRENE
DIAKON, PVC.
ACETATE, PERSPEX IN LUMP, SCRAP, FILM
GROUND AND REGROUND FORMS

HERBERT CONNOR LTD.

Send Samples and Details: 120, Beaufort Park, London, N.W.11

HIGHEST PRICES PAID ON ANY TERMS

Telephone: Speedwell 5023

INJECTION MOULDINGS

UP TO 12 OZS. CAPACITY IN

- DIAKON
- POLYTHENE
- POLYSTYRENE
- NYLON and P.V.C.

- 3-D MOULDINGS and NAME PLATES
- MACHINED PARTS IN PLASTICS and METALS
- PLASTIC COVERING
- WE OFFER OUR 30 YEARS' EXPERIENCE TO YOUR NEEDS

Ketch PLASTICS LTD

Contractors to H.M. Government

Telephone: LICHFIELD 3591–2

Trent Valley Works, Lichfield, Staffs.

Plastics Classified Advertisements

PRESS DAY.—Classified advertisements for the November issue must be received at Head Office by first post Monday, October 27.

Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.

RATES.—6d. per word (minimum 12 words 6/–). Each paragraph charged separately and name and address must be paid for. Semi-displayed setting 2 gns. per single column inch. Series discounts of 5% for 6, and 10% for 12 consecutive insertions allowed to trade advertisers.

TERMS.—Strictly net and prepayable. Monthly accounts for settlement by the end of the month following insertion are allowed to trade advertisers if satisfactory references are provided.

REMITTANCES.—Cheques and postal orders should be crossed and made payable to TEMPLE PRESS LIMITED and instructions sent addressed to the Manager, "Plastics," Bowling Green Lane, London, E.C.1.

THE PROPRIETORS retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printers' errors although every care is taken to avoid mistakes.

BOX NUMBERS.—Private advertisers desiring to have replies sent care of "Plastics" may do so on payment of 1/– to cover booking and postage, plus cost of four extra words. Box numbers must not be used for the purpose of circularizing and the proprietors do not undertake the distribution of such matter received. To avoid mistakes in forwarding, Box numbers should be carefully and legibly copied and replies sent to Box P000, care of "Plastics," Bowling Green Lane, London, E.C.1

DEPOSIT SYSTEM.—Facilities are available to readers to purchase advertised goods on approval by depositing the purchase price with "Plastics." Full details on application. Commission 1% (minimum 2/–) on amount deposited.

HEAD OFFICES.—Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus, London Telex." Telex: 23839.

BRANCH OFFICES: Bayliss House, Hurst Street, Birmingham, 5. Telephone: Midland 6616. 50, Hertford Street, Coventry. Telephone: Coventry 62464. 1, Brazennose Street, Manchester. Telephone: Deansgate 6114–8. 12, Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

BUSINESS OFFICES AND PREMISES

CITY BORDERS, E.C.2. New commercial and industrial building. Area about 20,000 sq. ft. Ground floor showroom. Good lift. Central heating. Good loading bay. New lease at low rent of £8,250 p.a. excl. Inspection strongly recommended. Apply: Chamberlain & Willows, 23 Moorgate, E.C.2. MET. 8001. 253-1432

LEATHERHEAD, SURREY. 27,000 sq. ft. modern single-storey factory, with first floor canteen and stores. Good natural lighting. Office suite. Central heating, concrete roadways and good loading. Freehold, £52,500. Chamberlain & Willows, 23 Moorgate, E.C.2. MET. 8001. 253-14

BUSINESS OPPORTUNITIES

MANUFACTURING COMPANY required by large industrial concern, preferably within 20 miles of Manchester. An opportunity for companies whose development is restricted to benefit from Group organisation. Existing management and staff will be retained. Information should show sales, production capacity and potential development. Box P537, care of "Plastics." 253-29

PERSON capable opening own company in injection moulding but short of finance, required for project. Opportunity for partnership. Write in confidence to W. A. Ord & Co., Bridgefield Gardens, Greenstead Rd., Colchester, Essex. 253-37

WELL-KNOWN old-established trading and manufacturing company, with offices and considerable factory space in England and Scotland, wishes to expand its activities in trading and manufacture. Gentlemen wishing to join and having expert knowledge and connections in a particular sphere, able to work on their own initiative, are invited to submit in the first place a short resume of their proposed activities. Basis: salary plus share of profits. Every offer will be treated as strictly confidential and examined by Managing-Director. Offers to Box P5318, care of "Plastics." 255-1483

PLANT POTS (IMPROVED). Plastic manufacturers, distributors or wholesalers who would finance the production, distribution, of millions of multi-purpose flower pots, etc., on commission or patent royalty basis. Kindly contact G. C. Everest, 19 Hazel Grove, Irby, Cheshire, stating extent of U.K. and export connections with the horticultural and household trades. 253-x1512

CONSULTANTS

W. BRUCE BROWN, F.R.S.A., M.S.I.A., Industrial Designer, 140 Roding Rd., Loughton, Essex. Phone Loughton 4138. 253-1433

GLASS FIBRE KITS

AUTOPLAX Glass Fibre Experimental Kits containing glass fibre mat, woven glass cloth, polyester resin, catalyst, accelerator and full instructions for use. All items available separately ex-stock. Kits at 21s., 35s., 50s.. £6 and £9 10s., post free. Automobile Plastics Co., Ltd., Autoplax House, 62–64 High St., Barnet, Hertfordshire. Barnet 9147. Telegrams: Autoplax-Barnet. zzz-167

MACHINERY, TOOLS AND PLANT

HYDRAULIC. Frazer mono-radial pumps, new and secondhand, in stock. Thompson & Son (Millwall), Ltd., Cuba St., London, E.14. East 1844. zzz-158

MIXERS AND BLENDERS. Usually a varied selection available for quick delivery. Enquiries welcome. Winkworth Machinery Ltd., 65 High St., Staines, Middlesex. 256-1410

NEW High-Speed 12-in. Electric Bandsaws for sale. For cutting polythene, p.v.c., rubber, Perspex, cork, leather, cloth, etc., with 8 speeds. 400/440/3 phase supply. Illustrations and prices from makers: F. J. Edwards Ltd., 359 Euston Rd., London, N.W.1. EUSton 4681. 253-15

Machinery, Tools and Plant (contd.)

COMPLETE MANUFACTURING PLANT for continuous production of expended Polystyrene Pop-corn together with large Block Making Moulds and Laboratory Pilot Mould. This equipment becomes available due to a change in manufacturing policy and this Company will no longer be engaged in the production of Expended Polystyrene.
THE PLANT is complete with motor, all necessary valves and piping for connection to steam and electricity supplies for immediate production. Full technical assistance will be given to the Buyers and stocks of raw material at concessional prices are available.

Price £1,000, loaded on lorry at Slough.

PHOENIX RUBBER CO., LTD.,
2K BUCKINGHAM AVENUE,
TRADING ESTATE,
SLOUGH, BUCKS.
Slough 22307. 253–8

ONE LANSING BAGNALL STAND-ON-REACH FORK TRUCK, complete with Ironclad battery of 240 a.h. Capacity 1,680 lb. 40 in. load length. Overall length 60 in., overall width 34½ in., overall height 95 in. Telescopic lift (electro-hydraulic) of 12 ft. Lifting speed 20 ft./min. Electro-hydraulic reach 30 in. Equipped with two adjustable forks 30 in. long. Less built-in charger. Fitted with overload and low voltage release circuit breaker and electric push-button type horn.
Apply Ashdowns Ltd., Eccleston Works, St. Helens, Lancs. Phone 3206, ext. 13. 253-16

TWO RICE HYDRAULIC UPSTROKE PRESSES. Four-column type, 2 in. ram. Stroke approximately 16 in. Fully guided table 14 in. × 9 in., one with 2 electrically heated platens 9¼ in. × 8¾ in. × 3 in., one with single platen. £95 each.
Hodson & Co. (Machinery), Ltd., Spring Mills, Tottington, Nr. Bury. 253-18

ONE 2-IN. PLASTICS EXTRUDER, electrically-heated barrel, with 6/3 h.p. 2-speed motor, water bath and haul-off gear.
Hodson & Co. (Machinery), Ltd., Spring Mills, Tottington, Nr. Bury. 253-17

JIGBORING M/c NEWALL No. 1. Table 24 in. × 36 in. Excellent condition. Phone Byfleet 3252. 253-25

WANTED several 3 oz., 4 oz., and 8 oz. injection machines. Please write Box P5219, care of "Plastics." 254-1479

HOBART MIXING MACHINE, 80-quart with stainless steel bowl. Two Mitchell electrically-heated drying ovens, each with 2 trucks and 80 enamelled trays. All in excellent condition. Box P539, care of "Plastics." 253-31

RUBBER PLANT

Francis Shaw Intermix Plant, comprising size K.3 Intermix driven by 70 h.p. S.R. motor, Compressor, Electrically-driven Elevator and Electrically-driven Sheeting Mill with rolls 60 in. × 22 in. Driven by 75 h.p. S.R. motor.

Banbury Mixer by David Bridge, size 00, suitable for laboratory or small scale production. 10/20 h.p. drive.

3-in. Extruding Machine by Iddon Bros., 3-speed drive by 12 h.p. motor. Previously used p.v.c. wire covering, c/w oil heater unit by Barlow Whitney.

GEORGE COHEN, SONS & CO., LTD.,
SUNBEAM RD., N.W.10.
Tel.: ELGar 7222/7.

STANNINGLEY, NR. LEEDS.
Tel.: Pudsey 2241.
253-11

WESTMINSTER (Dowding & Doll) 10 GRAMME CAPACITY HAND INJECTION MOULDING MACHINE in perfect condition. Little used. Quantity (virgin) various colours, polystyrene granules. Best offers. Box P5319, care of "Plastics." 253-x1493

Machinery, Tools and Plant (contd.)

THREE HAND TOGGLE PRESSES for sale. Berges, type, 15/20-ton capacity. Good machines for producing plastic mouldings and general press work. Space required—bargain prices to clear, singly or as a lot. Enquiries to S. Ward, 24 Cunliffe Rd., Blackpool. 253-1430

PLASTICS MACHINERY
Hydraulic Presses of all sizes. Injection Machines. Extruders. Mixing Mills. Hydraulic Pumps and Accumulators.
Send your requirements to the specialists.
REED BROTHERS (ENGINEERING), LTD.,
REPLANT WORKS,
WOOLWICH INDUSTRIAL ESTATE, S.E.18.
Phone: Woolwich 7611. 253-1

MACHINERY, TOOLS AND PLANT WANTED

INJECTION MOULDING MACHINES required. Condition or size not important. Send details Box P497, care of "Plastics." 254-1367

EXTRUDER and VACUUM FORMING MACHINES wanted. Send full details Box P515, care of "Plastics." 256-01411

BRADLEY & TURTON 360-TON or similar 250-ton Compression Press required. State stroke, platen size, age, etc., to Twinco Ltd., Warstock Rd., Birmingham, 14. 253-19

¾-OZ. INJECTION MOULDING MACHINE required. Send full details Box P534, care of "Plastics." 253-x1075

INJECTION MOULDING MACHINES wanted. 8-oz. to 16-oz. and larger. Send full details and price. Box P5314, care of "Plastics." 255-1482

THREE-DIMENSIONAL DIESINKING MACHINE. Deckel or Alexander. Details and price to Box P535, care of "Plastics." 253-27

MOULDS

YOUR DESIGN
OUR DESIGN
MOULDS TO YOUR SATISFACTION
AND OURS.
PRECONOMY CO. LTD., TOOLMAKERS.
Eastfield side, Sutton-in-Ashfield, Notts. zzz-146

COMPRESSION MOULDS FOR SALE. Production of Household Articles, Smokers' Sundries, Fancy Goods, etc. Box P495, care of "Plastics." 254-1366

INJECTION MOULDS.
COMPRESSION MOULDS.
TRANSFER MOULDS.
OUR DESIGN — YOUR DESIGN.
ENGRAVING. HEAT-TREATMENT.
ANY OR ALL SERVICES AVAILABLE.
LEIGH TOOL & GAUGE CO., LTD.
EMPIRE WORKS, CLEVELEYS, LANCS.
Established over 25 years. zzz-172

INJECTION AND COMPRESSION MOULDS. Designed and made by Anglo Cutting Tool Co., 117–119 Marlborough Rd., Romford, Essex. Romford 3182. 253-1425

PATTERNS AND MOULDS, any size made in plaster and glass fibre by experienced tradesman. Let me quote you for the awkward patterns and save cost. Box P531, care of "Plastics." 253-x719

PATENTS

INVENTION HAVING WIDE DOMESTIC APPLICATION, plastic extrusion. Information from Patent Applicant, Mr. Joyce, 71 Lydgate Lane, Sheffield. 253-x1231

PORTABLE POWER TOOLS

NEW, used, bought, sold, exchanged; terms. Hall Drysdale and Co. Ltd. 58 Commerce Rd., Wood Green, London, N.22. Bowes Park 7221. 255-1447

PRODUCTION CAPACITY AVAILABLE

INJECTION MOULDINGS by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 256-1120

VISIJAR LABORATORIES, LTD.
THE LEADING CRAFTSMEN IN "PERSPEX."
PROTOTYPE AND REPETITION.
OFFICIAL I.C.I. STOCKISTS "PERSPEX."
SHEET, TUBE, ROD.
STOCKISTS AND FABRICATORS OF "FORMICA."
149 LONDON ROAD, CROYDON, SURREY.
Phone, Croydon 8228 (two lines) zzz-133

SILICONE RUBBER MOULDING. Capacity available for prototype and repetition work. ESCO (Rubber) Ltd., 2 Stothard Place, Bishopsgate, London, E.C.2. zzz-164

MOULDS, INJECTION, COMPRESSION AND TRANSFERS, DIESINKING, DESIGNS. Competitive prices. Russell Engineering Co., Ltd., Russell Rd., Croydon. Thornton Heath 4128. 222-175

GLASSFIBRE reinforced plastic mouldings by Payne & Payne Ltd., 6/10 Priory Mews, London, S.W.8. Own design and pattern making department. Expert laminating team. Phone Macaulay 7687. 253-23

ALL TYPES INJECTION MOULDINGS, 2 oz. including tool manufacture and design service, under one roof. O.P.H. Ltd., Old Brickworks, Church Road, Harold Wood, Essex. Ingrebourne 41513. 222-179

INJECTION MOULDING, 3 oz. and 4 oz. Martin-Golod Ltd., Marbury Gardens, London, N.W.10. WILlesden 3888. 253-1334

ENQUIRIES
INVITED FOR
INJECTION MOULDINGS.
WESTMINSTER PLASTICS LTD.
TEMPLE WORKS,
41 OLD CHURCH RD.,
CHINGFORD, E.4.
Phone Silverthorn 7927. 222-178

VACUUM-FORMED PLASTICS. "It's not cricket," but we delight in taking short runs, particularly in large moulding areas. B. T. Bennett & Co., 449 Alexandra Ave., Harrow. zzz-185

SPA PLASTICS (Division of Spa Brushes Ltd.). Injection moulders to customers' specifications up to 32 oz. Enquiries invited. Technical Advice Service available. Freeman Works, Chesham, Bucks. Phone Chesham 371 (P.B.X.). zzz-190

NYLON, POLYSTYRENE AND ACETATE INJECTION MOULDINGS up to 2 oz. Reliable service. Latest-type machines. Keen co-operation on new lines. W. H. Adamson Plastics, Ltd., 39 Hedley St., Maidstone. 256-1408

VACUUM-FORMED PLASTICS. Design, printing and production capacity available. The Delta Plastics, Worcester Place, Oxford 57838. 256-1424

INJECTION MOULDING CAPACITY. Considerable tool-cost savings based on 23 years' experience. Design advice. Martin's Products Ltd., 91–92 Turnmill St., E.C.1. CLErkenwell 6070. 256-1444

SORTING, Washing, Chipping and Screening of customers' materials carried out under expert supervision. P.V.C., Polythene, etc. Leeplas Products, Carlton Works, Johnson Street, Tyldesley, Nr. Manchester. zzz-198

PLASTICS (MANCHESTER), LTD.,
BRITAIN'S LEADING STOCKISTS AND DISTRIBUTORS.
SPECIALISTS IN
FABRICATION, INJECTION MOULDING AND ENGRAVING.
HANOVER WORKS, BUXTON STREET,
LONDON ROAD, MANCHESTER, 1.
Phone ARD 4567 (5 lines).
253-308

INDUSTRIAL INSTRUMENT SERVICES CO., 74A Nursery Rd., Birmingham, 19 (NOR 2525). Pyrometer instrument manufacturers and suppliers, reconditioning of all types and makes of Pyrometer instrument and thermocouple, etc., as used in Plastics Industry. Guaranteed work, prompt delivery. 253-12

RAW MATERIAL

BLACK POLYTHENE GRANULES. Large supplies always available at 1s. 9d. per lb. Box P472, care of "Plastics." zzz-0177

PLASFILA. New, White, Water Levigated, inert, Filler or Loader, for Rubber and Plastics. Increases strength, reduces costs. Henshaw & Co., 97 Clearmount Rd., Weymouth. 254-1362

POLYTHENE TAPE. Natural or Ivory Continuous length reels ¼ in. to 3½ in. wide, 0.010 in. to 0.060 in. thickness Box P5115, care of "Plastics." 253-1413.

PLASTIC DISCS.
EX BUTTON BLANKS.
Enormous quantities in all sizes and colours, cheap to clear. Write for stock lists and prices to:
DORMER PLASTICS LTD.
TRADING ESTATE, WEST HARTLEPOOL.
253-4

REGULAR QUANTITIES of Polythene, Polystyrene. P.V.C. for disposal. Box P5116, care of "Plastics." zzz-196

CUEX LTD., can offer all at prices well below current list:—
Polystyrene.
Cellulose acetate.
Polyethylene.
P.V.C.
Polyvinyl butyral.
Perspex and Diakon.
Send now for details.
Cuex Ltd., 270 Corporation St., Birmingham. Central 5474. 253-7

QUANTITY of ⅛ in. thick pink cellulose acetate sheeting, black wire reinforced acetate sheeting, Perspex off-cuts for disposal. Apply Box P538, care of "Plastics." 253-30

10-12 TONS "PARAPLEX G-25" POLYMERIC PLASTICIZER for sale at bargain prices. Particularly advantageous for nitrocellulose at low temperatures. Produces no skin irritation when applied undiluted to the skin! Samples, particulars, from Box P514, care of "Plastics." 253-24

APPROXIMATELY 3 cwt. to 4 cwt. plain white, pale blue and pink p.v.c. sheeting, .004 in. thick, 34 in. wide, in original wrappings, average roll weighs 35 lb. giving 165 yds. 2/6 per lb., 40% below purchase price. Thomas Harris (Birmingham) Ltd., 473 Lichfield Rd., Birmingham. 253-x1232

RAW MATERIAL WANTED

HERBERT CONNOR LTD., Buyers of all Scrap. Top prices paid on any terms for Polythene, Polystyrene, Diakon, Perspex, P.V.C., Acetate, Nylon, in lump, scrap articles, ground and re-ground forms and film offcuts. Please send samples and details to: 120 Beaufort Park, London, N.W.11. 253-2

POLYETHYLENE MOULDING POWDERS, lay-flat tubing and scrap of all kinds wanted against prompt cash payment. Box P398, care of "Plastics." zzz-147

POLYTHENE, P.V.C., PERSPEX, POLYSTYRENE, any quantity, urgently required. Multitex Ltd., 12 Penzance Place, Portland Rd., London, W.11. Phone Park 2611. zzz-184

WANTED, Polythene scrap. Write to Box P221, care of "Plastics." zzz-132

SPOT CASH BUYERS of all thermoplastic injection scrap and redundant virgin lots. Regular collections. WG Plastics, 14 Cambridge Park Mews, Twickenham, Middlesex. Popesgrove 1800. 258-1305

BROCKWELL PLASTICS LTD., 50 Hollingbourne Rd., S.E.24, will purchase redundant polyethylene scrap of all kinds. We collect and pay cash on collection. Box P399, care of "Plastics." zzz-148

WANTED all types of Polythene Scrap. Send details and samples to: Tyruplex Ltd., 111 High St., N.W.10. Elgar 2684. 253-5

LEEPLAS PRODUCTS require all types of Scrap, P.V.C., Polythene, Polystyrene, etc., in any form. Best prices paid. Details and samples to Carlton Works, Johnson Street, Tyldesley, Nr. Manchester. zzz-197

POLYTHENE SCRAP. Top prices paid on any terms for any form of polythene scrap, i.e. extrusion lumps, scrap articles, film offcuts, ground and re-ground forms. Please send details and samples to: Herbert Connor Ltd., 120 Beaufort Park, London, N.W.11. 253-3

Raw Material Wanted (contd.)

THERMOPLASTIC SCRAP AND MOULDING POWDERS. We buy large and small quantities and pay prompt Cash. Offers to J. W. Nash & Co., Ltd., 27 Beethoven St., W.10. Ladbroke 4655/6/7. 253-21

ALL TYPES THERMOPLASTIC SCRAP wanted. Quantity immaterial. Send offers and samples to Victor Grant Plastics Ltd., 67 Westbourne Grove, London, W.2. Park 2681–2. zzz-201

REFRIGERATION & AIR CONDITIONING PLANT

FRIGIDAIRE LOW TEMPERATURE REFRIGERATORS, 49 in. wide × 28 in. deep × 34 in. high. Ext. Ex large national user, suitable A.C. or D.C. deep freezing, storage of ice-cream, frozen foods, etc. Price £40 each. Domestic refrigerators, service cabinets, and cold rooms also available. A.R.C., 134 Great Portland St., London, W.1. MUSeum 4480. zzz-171

SITUATIONS VACANT

FOREMAN wanted for established reinforced plastic moulding company. Applicants must have wide experience in contact moulding with preferably some experience in bag or resin injection (R/P) moulding. Please write for interview, giving details of experience, background, etc., to Glass Fibre Laminates Ltd., White Lund, Morecambe, Lancs. 253-9

PLASTICS RESEARCH. Plastics Technologist required for modern laboratory of large industrial group. A knowledge of thermoplastics particularly p.v.c. is required and a University graduate would be preferred but consideration would be given to a man with very sound practical experience in this field. First-class working conditions, pension scheme, etc. Good salary and prospects. Write giving full details of education, career, to date, and salaries earned, to Staff Manager, Marley Tile Co., Ltd., London Rd., Riverhead, Sevenoaks. 253-10

SALES MANAGER required by important company specialising in Industrial Mouldings, injection and compression, with factory in the London area. This is a high level position with considerable scope. Qualifications: Engineering training with sound commercial experience and the ability to deal with trade customers and Government Departments at the highest level, also the ability to formulate policy and control staff. Salary necessary to secure the right person will be paid. Excellent conditions with pension scheme and bonus payable on results. Age 30–45. Write Box T.1940/3, Foster Turner & Everetts Ltd., 11 Old Jewry, London, E.C.2. 253-13

SENIOR TECHNICIAN required having knowledge of glass fibre development. Write giving full details of age, education, experience and salary required, to The Works Director, Insulation Equipments Ltd., Oswestry, Shropshire. Housing accommodation can be arranged. 253-20

THE METAL BOX COMPANY
OF INDIA, LIMITED,
requires a
SENIOR PLASTICS TECHNOLOGIST

to take charge of the technical aspects of manufacturing plastic and flexible packaging products. Commensurate salary and allowances will be paid.

Operations, based mostly at Calcutta, will involve Injection Moulding, Extrusion, Bottle Blowing and Lamination.

Applicants must have considerable scientific or technological competence in at least one relevant field, but the appointment in India will not be operative for some months, during which time necessary training will be provided at Research Department and factories in England.

Responsibilities in India will include:

(*a*) Assessment and evaluation of raw materials available in India.

(*b*) Assistance to suppliers in development of suitable raw materials.

(*c*) Technical supervision of all production.

(*d*) A leading role in building a large plastic container and flexible packaging output.

Write to Staff Division,
THE METAL BOX CO., LTD.,
37 Baker St., London, W.1.
Quoting Reference ICX/1.
253-22

Situations Vacant (contd.)

LECTURER AND DEMONSTRATORS required in Metallurgy or the Materials Sciences, to teach at post-graduate level in specialised fields. There is a particular requirement for specialists in non-metallic materials or in metal technology, but other branches are relevant. Good facilities exist for research and publication is encouraged. Demonstrators must be academically qualified and will, if suitable, be considered for subsequent promotion to Lecturer. A housing scheme is in operation at the College. Salary within scales: Lecturer £900 × £50—£1,350 × £75—£1,650; Demonstrator: £650 × £25—£1,000; with F.S.S.U. and family allowances. Applications, including names of three referees, to: Recorder, The College of Aeronautics, Cranfield, Bletchley, Bucks. Further particulars available. 253-26

MILL SHOP SUPERVISOR required for London factory. Experienced rubber and plastics compounding and with sufficient chemical background for testing, etc. Must be able to handle labour and production from Banbury mixers on shift work. Age 30/50. Apply with full details, qualifications, previous experience and positions held, to Box No. M5250, Haddon's, Salisbury Square, London, E.C.4. 254-1477

SENIOR LEATHERCLOTH CHEMIST required by Bernard Wardle (Everflex) Ltd. Experience in the coated fabrics field, with particular reference to p.v.c. essential. Applications, giving full details, including salary required, should be addressed to the Managing Director, Peblig Mill, Caernarvon, North Wales. 254-1478

AS A RESULT OF EXPANSION, Tenaplas have the following vacancies:

Foreman for shaping and vacuum forming shop. Only men with wide experience in the forming of perspex, p.v.c. and polystyrene need apply.

Tool Design Draughtsman required, preferably with experience on extrusion dies but all round knowledge of die and mould design acceptable.

Foreman for expanding tool room, must have wide experience and already holding a job of similar calibre.

UPPER BASILDON, NR. PANGBOURNE, BERKS. 255-1480

COMPRESSION MOULDING SHOP FOREMAN required. Near London. Write stating full details of experience. Box P5313, care of " Plastics." 256-1481

LEADING TOY MANUFACTURERS
HAVE THE FOLLOWING VACANCIES:

Foreman with thorough knowledge of vinyl doll production.

Modeller and Designer for novelty toys—good opening for man with ideas.

Doll Dress Designer with ability to plan complete range of dolls' dresses suitable for mass production.

Write in the first place to Box P536, care of " Plastics."

253-28

RAPIDLY EXPANDING PLASTICS COMPANY, S.E. London, invite enquiries from Sales Representative with drive, imagination, and Industrial user connections in S.E. England. Knowledge of injection and compression moulding, fibre glass, industrial laminates and technical background essential. Reply Box P5310, care of " Plastics." 253-32

Situations Vacant (contd.)

APPLICATIONS ARE INVITED for the following appointments in the Injection Moulding Department of a large and progressive firm of Plastic Moulders in the Midlands.

Applications which will be treated in confidence should include full details of technical experience.

SHOP FOREMAN.
RATE-FIXER.
INSPECTOR.
HYDRAULIC FITTER.

Reply to Box P5312, care of " Plastics." 253-34

MAN required to supervise production and handle quotes. Small trade tool shop. Aim expansion. Good prospects. East Anglian District. Box P5316, care of " Plastics." 253-36

PLASTICS ENGINEER.

Required for Methods Department of modern factory some 60 miles from London.

Experience in Thermo-setting and Thermo Plastics essential plus O.N.C. or equivalent. Apprenticeship desirable.

Commencing salary £900 per annum.

Apply to Personnel Manager, Box P5317, care of " Plastics." 253-38

OPENING in Plastics Industry. Small company requires person experienced in injection moulding tools to take complete charge of new small works. View to rapid expansion and possible participation. East Anglian district. Box P5315, care of " Plastics." 253-35

THE PLASTICS DIVISION OF
UNIVERSAL METAL PRODUCTS LTD.

invite applications for the position of

MANAGER

for their Southport factory.

Applicants should have held a managerial position. A thorough knowledge of thermoplastic moulding an advantage but not a condition. The appointment carries a four-figure salary and bonus according to qualifications. Attractive Pension Scheme and other benefits. The position offers great prospects and emoluments will be kept in line with proved ability.

Applications, which will be treated in strict confidence, should be addressed to the Managing Director.

UNIVERSAL METAL PRODUCTS LTD.,

SALFORD, 6.

253-1111

DESIGNER-DRAUGHTSMAN with sound knowledge and experience in design and development of moulds and ancillary equipment for injection moulding, required. Good working conditions. Staff bonus and pension scheme in operation. Apply in writing giving details of experience, etc., to Injection Moulders Ltd., Westmoreland Rd., Queensbury, N.W.9. 253-x1185

SITUATIONS WANTED

YOUNG MAN (21), completing Plastics Technology Course, preparation City and Guilds, seeks situation any branch of the industry. Box P533, care of " Plastics." 253-x1146

Situations Wanted (contd.)

EXECUTIVE, 35, with drive and ambition, experience plastics, rubber, sales, production, development, publicity and advertising, etc., seeks responsible position where abundant energy, enthusiasm and imagination are appreciated. Box P532, care of " Plastics." 253-x1145

TIME RECORDERS

FACTORY TIME RECORDERS. Service rental. Phone, Hop 2239. Time Recorder Supply and Maintenance Co., Ltd., 157–159 Borough High St., S.E.1. 257-1206

WANTED

PERSPEX ROOFING SHEETS wanted. 6-in. corrugations. Ex-Govt. or clearance stock. Box P5311, care of " Plastics." 253-33

WATER COOLING EQUIPMENT

DON'T DRAIN YOUR PROFITS. Save approximately 98% of your water. Install a "SILENT FALLS" recirculating water cooler. Constant pressure at controlled temperatures. Details from makers. Mechanical Kold Ltd., 411 West Green Rd., Tottenham, N.15. Bowes Park 9635. zzz-182

BOOKS AND PUBLICATIONS

THE PROPERTIES AND TESTING OF PLASTICS MATERIALS, by A. E. Lever and J. Rhys. A new book containing in a convenient form all the available information on the physical and chemical properties and methods of testing plastics. Over 1,600 references, a comprehensive glossary of reference abbreviations and an extensive index are to be found in this volume which will serve as a standard work of reference to all who manipulate or use plastics materials, and in particular will be invaluable to research workers, development staffs, inventors and students in the plastics and associated industries. 207 pages. Price 30s. net from booksellers, or 31s. 2d. by post from the publishers, Temple Press, Ltd., Bowling Green Lane, London, E.C.1. zzz

MOULDS FOR PLASTICS, by W. M. Halliday. Meets the needs of both mould designer and toolmaker. Discusses design, construction, operation and maintenance and problems in the light of practical experience. Illustrated. 286 pages, 30s. net from booksellers, or 31s. 3d. by post from the publishers, Temple Press, Ltd., Bowling Green Lane, London, E.C.1. zzz

PLASTICS, SCIENTIFIC AND TECHNOLOGICAL (3rd Edition), by H. R. Fleck. A recognized standard work on the chemistry and technology of plastics. Illustrated. 400 pages, 40s. net from booksellers, or 41s. 3d. by post from the publishers, Temple Press, Ltd., Bowling Green Lane, London, E.C.1. zzz

CELLULOSE ACETATE PLASTICS, by Vivian Stannett. A complete technical survey of one of the most popular and adaptable products of the plastics industry. Illustrated, 284 pages, 30s. net from booksellers or 31s. by post from the publishers, Temple Press, Ltd., Bowling Green Lane, London, E.C.1. zzz

THE THEORY OF POLYMERIZATION. by H. R. Fleck. A full explanation in simple language with examples, calculations and exercises of this fundamental aspect of the chemistry of plastics. Illustrated, 144 pages, 10s. 6d. net from booksellers, or 11s. by post from the publishers, Temple Press, Ltd., Bowling Green Lane, London, E.C.1. zzz

We Buy and Sell all types of

PLASTIC SCRAP

We welcome enquiries to grind customers' own material

Acetate
Butyrate
Nylon
Polyethylene

J. W. NASH & CO., LTD.

27 BEETHOVEN STREET, LONDON, W.10

Telegrams: NASPEX, NOTTARCH, LONDON
Telephone: LADBROKE 4655-6-7

Acrylics
Celluloid
Polystyrene
P.V.C.

INDEX TO ADVERTISERS

Name	Page
A	
Albright & Wilson (Mfg.), Ltd.	65
Algemene Kunstzijde Unie N.V.	39
Amber Oils, Ltd.	72
American Cyanamid Co.	11
Armstrong Patents Co., Ltd.	77
Asmidar Plastic Moulding Machines, Ltd.	82
Associated Lead Manufacturers, Ltd.	80
B	
Bakelite, Ltd.	60
Baldwin Instrument Co., Ltd.	32, 84
Ball, W. W., & Sons, Ltd.	66
Barber & Duffy, Ltd.	80
Beck, Koller & Co. (England), Ltd.	55
Benton & Stone, Ltd.	38
B.I.P. Engineering, Ltd.	1
B.I.P. Tools, Ltd.	69
Birkbys, Ltd.	68
Blackfriars Rotary Cutters, Ltd.	84
Boake, A., Roberts & Co., Ltd.	48
Boston Marine & General Engineering Co., Ltd.	78
Bradley & Turton, Ltd.	74
Brand, Ed., Ltd.	12
Bridge, David, & Co., Ltd.	50
Briggs Bros. (Engineers), Ltd.	105
Brightside Plating Co., Ltd., The	86
Bristol Aircraft, Ltd.	108
British Celanese, Ltd.	33
British Ermeto Corporation, Ltd.	78
British Oxygen Co., Ltd., The	13
British Resin Products, Ltd.	36, 37
Brown, Davidson & Co., Ltd.	92
Burtonwood Engineering Co., Ltd.	64
BX Plastics, Ltd. — Inside Front Cover	
BX Plastics, Ltd. (Miltoid Sales Division)	88
C	
Castle, John, & Co., Ltd.	104
Cellgrave Co., Ltd.	72
Cinema-Television, Ltd.	18
Cole, E. K., Ltd.	22
Cole, R. H., & Co., Ltd.	41
Commercial Plastics, Ltd.	14
Connor, Herbert, Ltd.	108
Cooke & Dykehouse Plastic Machinery Co., Ltd.	42, 43
Courtaulds Ltd. — Front Cover	
Coventry Motor & Sundries Co., Ltd.	27
Crystalate, Ltd.	19
D	
Dale, John, Ltd.	81
Dallow Lambert & Co., Ltd.	26
Derwent Plastics, Ltd.	54
Docker, John, & Co. (Engineers), Ltd.	104
E	
Ekco Electronics, Ltd.	88
Elco Plastics, Ltd.	59
Elliott, E., Ltd.	70
Elm Plastics, Ltd.	102
Evans, Frederick W., Ltd.	106
F	
Fawcett Preston & Co., Ltd.	85
Ferguson, James, & Sons, Ltd.	34
Fibreglass, Ltd.	93
Fibrenyle, Ltd.	35
Fraser, Andrew, & Co., Ltd.	20
Funditor, Ltd.	96
G	
General Electric Co., Ltd., The	99
Genristo, Ltd.	101
Grant, Victor, Plastics Co., Ltd.	106
Green, Albert, Ltd.	106
Griffiths, Gilbart, Lloyd & Co., Ltd.	96
Grilon & Plastic Machinery, Ltd.	10
Guest Keen & Nettlefolds (Midlands), Ltd.	62
H	
Harvey, G. A., & Co. (London), Ltd.	94
Hasler Telegraph Works, Ltd.	23
Hayes Engineers (Leeds), Ltd.	92
Holzverzucherungs A.G.	10
Honeywell Controls, Ltd.	91
Hunt & Mitton, Ltd.	76
Hunt & Moscrop, Ltd.	104
I	
Imperial Chemical Industries, Ltd., Plastics Division — 5, 16, Inside Back Cover	
Industrial Plastics, Ltd.	89
Insulation Equipments, Ltd.	7
Insulation Manufacturing Co. (Plastics), Ltd.	94
International Corporation, Ltd.	107
Iridon, Ltd.	14
Islington Metal & Plating Works, Ltd., The	100
K	
Kayser, Ellison & Co., Ltd.	47
Kendell, T., & Sons, Ltd.	108
Kent Mouldings	82
Ketch Plastics, Ltd.	108
King, Geo. W., Ltd.	83
Kleestron, Ltd.	56
L	
Lankro Chemicals, Ltd.	28
Ly-Bak, Ltd.	104
M	
M & B. Plastics, Ltd.	6
Marshall, C. & C., Ltd.	86
Melwood Thermoplastics, Ltd.	99
Mersey White Lead Co., Ltd., The	102
Metalin, Ltd.	107
Metal-Woods, Ltd.	106
Milton Engineering Co., Ltd.	102
Mitchell, L. A., Ltd.	30
Monsanto Chemicals, Ltd. — 45, 58, Back Cover	
N	
Napier, D., & Son, Ltd.	108
Nash, J. W., & Co., Ltd.	111
Negri Bossi & C.	49
Novadel, Ltd.	71
O	
Omega Plastics, Ltd.	90
P	
Peco Machinery Sales (Westminster), Ltd.	3, 4
Pendry (Plastics), Ltd.	97
Pepco, Ltd.	100
Phoenix Rubber Co., Ltd.	102
Pickfords Tank Haulage Service	98
Piece-Parts & Assemblies	103
Plant Installations, Ltd.	67
Precision Screw & Manufacturing Co., Ltd., The	98
Pressoturn, Ltd.	79
Price's (Bromborough), Ltd.	15
Punfield & Barstow (Mouldings), Ltd.	75
R	
Radio Heaters, Ltd.	44
Reliance Trading Co.	106
Resinoid & Mica Products, Ltd.	21
Resinous Chemicals, Ltd.	40
Rootes Mouldings, Ltd.	8, 9
S	
Sale, H. B., Ltd.	103
Shaw, Francis, & Co., Ltd.	24, 25
Shell Chemical Co., Ltd.	2, 51
Simmonds Aerocessories, Ltd.	73, 87
Spa Plastics	105
Steele & Cowlishaw, Ltd.	105
Sterling Moulding Materials, Ltd.	46
Stevens, Michael S., Ltd.	101
St. Just, Theodore, & Co., Ltd.	107
Stone, J., & Co. (Deptford), Ltd.	95
Streetly Manufacturing Co., Ltd., The	57
T	
Tensile Products, Ltd.	100
Textile Paper Tube Co., Ltd., The	76
Turner Brothers Asbestos Co., Ltd.	31
U	
United Ebonite & Lorival, Ltd.	63
Universal Metal Products, Ltd.	17
Utilex, Ltd.	90
V	
Vacuum Industrial Applications, Ltd.	97
W	
Wailes, George, & Co., Ltd.	102
Wallis Engineering Co.	100
Warbrick (Engineering Specialties), Ltd.	64
Wickman, Ltd.	52, 53
Wiggins Teape & Alex Pirie (Sales), Ltd.	29

EDITORIAL AND BUSINESS NOTICES

"PLASTICS" is published on the second Wednesday in each month in London, England, by TEMPLE PRESS LIMITED, and is registered for transmission to Canada and Newfoundland by magazine post. Entered as second-class matter at the Post Office, New York, N.Y.

EDITORIAL, ADVERTISEMENT, AND PUBLISHING OFFICES.—Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus, London, Telex." Telex: 23839.

BRANCH OFFICES.—Bayliss House, Hurst Street, Birmingham, 5. Telephone: Midland 6616. 50 Hertford Street, Coventry. Telephone: Coventry 62464. 1 Brazennose Street, Manchester, 2. Telephone: Deansgate 6114-8. 12 Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

EDITORIAL.—All editorial communication and matter must be addressed to the Editor and not to individuals. Drawings or MSS or other material not considered suitable will be returned if stamps are enclosed, but the Editor does not hold himself responsible for the safe keeping or safe return of anything submitted for his consideration. Payment for contributions will be made following publication.

ADVERTISEMENTS.—Whilst every precaution is taken to ensure accurate printing, the publishers will not be responsible for printers' errors, or for errors arising out of telephonic instructions relating to advertisement copy, nor will they be responsible for advertisement blocks destroyed by fire or that are left in their possession for more than one year. Advertisers must in all cases bear the cost of drawings, photographs and/or blocks used in their advertisements. Copy must be supplied without application from the publishers, and current copy and blocks will be repeated if new copy is not received at the time of closing for press. Orders for advertisements are subject to acceptance in writing from the Head Offices. Advertisement copy is subject to the approval of the publishers. All advertisements and contracts are accepted and made upon the express condition that the publishers have the absolute right to refuse to insert copy to which they may object for legal, public or trade reasons, and such refusal of copy shall not be a good ground for advertisers to stop a current contract or to refuse to pay for the same, or for taking action for breach of contract. The advertisers will indemnify the publishers against any damage sustained by them as the result of the inclusion of their advertisements. The publishers, whilst endeavouring to ensure that advertisements shall appear with all possible regularity, will not be held liable for any loss occasioned by the failure of any advertisements to appear from any cause whatever. The acceptance of an order does not confer the right to renew on similar terms. The publishers reserve the right to increase the advertisement rates at any time, or to vary the terms of contract as regards space or frequency of insertion. All orders are accepted on the understanding that any such increase in rate or other amendment may come into immediate operation on all outstanding insertions. In such event, the advertiser has the option of cancelling the balance of contract. Contracts relate to the advertisers own goods or services, and the space may not be sub-let or disposed of in any way. Conditions which are contained in order forms other than those of the Proprietors and which do not conform to, or are in addition to, the Proprietors' conditions, will not be recognized as binding. Special conditions must be subject to mutual agreement.

SUBSCRIPTIONS AND SUPPLIES.—"Plastics" is obtainable to order from newsagents and bookstalls or by post from the publishers at an annual subscription rate of 44/- (Canada and U.S.A. $6.50), postage included. Shorter periods pro rata. Subscriptions are prepayable. "Plastics" is obtainable from newsagents and bookstalls abroad through the following agents:—EUROPE—Messageries Dawson (S.A.), Paris; Messageries Hachette et Cie, Paris; W. H. Smith & Son, Paris and Brussels. CANADA—Wm. Dawson, Subscription Service Ltd., Toronto, etc., Gordon & Gotch, Ltd., Toronto. U.S.A.—Eastern News Co., 306 West 11th St., New York 14, N.Y. AFRICA—Central News Agency, Ltd., Cape Town; W. Dawson & Son (S.A.), Cape Town. ASIA—W. Thacker & Co., Ltd., P.O. 190, Bombay. AUSTRALIA and NEW ZEALAND—Gordon & Gotch (A'sia), Ltd.

REMITTANCES.—Postal orders, cheques, etc., should be made payable to TEMPLE PRESS LTD.

COMMUNICATIONS.—All orders, letters and inquiries regarding advertisements, subscriptions, and other business matters should be addressed to the Manager, "Plastics," Bowling Green Lane, London, E.C.1.

Published monthly by the Proprietors, TEMPLE PRESS LIMITED, Bowling Green Lane, London, E.C.1, and printed in England by SIR JOSEPH CAUSTON & SONS, LTD., Eastleigh.

Tuboplast containers made from 'Alkathene' I.C.I. polythene by Cascelloid Limited, Leicester.

It looks better, sells faster in a Container made from 'Alkathene'

THESE NATIONALLY known products are attractively presented. They're hygienically and safely presented, too. They're packed in 'Alkathene'.

See how the names and trademarks stand out! That's because 'Alkathene' takes printing so well, in colour or in black and white. Furthermore, the 'Alkathene' itself is available in a wide range of gay, eye-catching colours.

'Alkathene' combines flexibility with strength. It has a good feel. It is inexpensive. It is, in fact, the ideal material for packing a wide range of products such as these*, whether they be in liquid, cream or powder form. No wonder Cascelloid Ltd. chose 'Alkathene' the I.C.I. brand of polythene to make these Tuboplast containers for their clients.

**If you want to know whether you can pack your Product in 'Alkathene' telephone :—*

London—Grosvenor 4010 **Manchester**—Deansgate 2466
Glasgow—City 5020 **Birmingham**—Central 7070

'ALKATHENE'

'Alkathene' is the registered trade mark for the polythene made by I.C.I.

IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

ICI

P.649.

Vol. XXIII No. 253 **Plastics** OCTOBER, 1958

For a better job in Polyethylene . . .

see Monsanto first!

Monsanto Polyethylene is manufactured by the high pressure process. It is produced in a wide range of grades, suitable for:

Extrusion — Film and lamination
Wire and cable coating
Tubing

Moulding — Injection moulding
Blow moulding

Monsanto Polyethylene is backed by a technical service specially qualified to advise you on all processing and application problems. Write now for more information.

Monsanto

Monsanto chemicals and plastics help industry — to bring a better future closer

Monsanto Reg'd.

MONSANTO CHEMICALS LIMITED, PLASTICS & TECHNICAL PRODUCTS DIVISION,
571 Monsanto House, Victoria Street, London S.W.1, and at Royal Exchange, Manchester, 2.

In association with: Monsanto Chemical Company, St. Louis, U.S.A. Monsanto Canada Limited, Montreal. Monsanto Chemicals (Australia) Limited, Melbourne. Monsanto Chemicals of India Private Limited, Bombay. Representatives in the world's principal cities.

B2